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THE BUTTERFLIES OF THE DISTRICT OF COLUMBIA AND VICINITY

BY

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The present work forms No. 157 of the *Bulletin* series.

Alexander Wetmore,
Assistant Secretary, Smithsonian Institution.

Washington, D. C., *October 31, 1931.*

PREFACE

During the 24 years which have passed since I first became a more or less continuous resident of the District of Columbia, the great extension of the city of Washington, and especially the development of suburban areas within and adjacent to the District, have brought about very considerable changes in the faunal balance.

These changes have been evident to everyone with even a casual interest in butterflies. Several species have not been seen in the District for many years, while others have disappeared quite recently. Many that presumably were once common are now very rare or merely casual. Several others occur only in isolated colonies in very limited areas of boggy ground which are certain to be filled in within the next few years, resulting in the elimination of all traces of the butterflies.

Yet this region is a singularly interesting one, a sort of meeting ground for northern and southern, mountain and coastal plain species or forms. Indeed, one single species (*Cercyonis alope*) occurs in no less than three distinct forms, a dark northern coastal (*maritima*), a northern interior (*alope*), and a very pale southern mountain form, while there is a possibility, judging from individuals seen but not caught, that even a fourth form, the southern coastal (*pegala*), is also found here.

In view of all this, it has seemed worth while to present a somewhat detailed account of the local fauna as I and others have known it in the past and as it is to-day.

The seasons of the various species and the habits of the individuals differ more or less, and often to a considerable degree, in different areas within their range. Much attention has therefore been devoted to this phase of the study of the local butterflies. Many species have been raised, but in most cases no information worthy of record was obtained.

While the observations upon which this account of the District butterflies is based have extended over many years, it has not been possible to devote much time to intensive study. Usually during the season I spent a part of each Sunday in the field, and in the past five years also devoted occasional week days to the work.

During the course of these studies I have had the constant cooperation of Dr. L. O. Howard, Dr. William Schaus, Dr. William T. M.

Forbes, the late Dr. Harrison G. Dyar, Harold H. Shepard, and John Barnes. Among those who have accompanied me on excursions in the field are Dr. Karl Jordan, of Tring; Dr. H. Boschma, of Leiden; Dr. Kai L. Henricksen, of Copenhagen; Dr. Torsten Gislén, of Uppsala; Dr. William T. M. Forbes, Dr. William M. Mann, Dr. Adam Böving, Herbert S. Barber, George R. Putnam, Dr. Herbert Friedmann, A. Brazier Howell, Irvin N. Hoffman, James A. Hyslop, and Foster H. Benjamin.

I am indebted to Clement W. Baker, of Waynesburg, Ohio, for a considerable number of specimens from his region for comparison with local forms, and I am similarly indebted to Dr. G. W. Rawson, of Detroit, Mich., and to C. V. Blackburn, of Stoneham, Mass.

Dr. Hugh M. Smith, of Bangkok, Siam, was so very kind as to provide me with Siamese butterflies for experimentation in regard to the emanations from their wings, while Dr. Nagamichi Kuroda, of Tokyo, and Prof. Tamigi Kawamura, of the Imperial University, Kyoto, Japan, were so good as to send me specimens of the Japanese forms of those wide-ranging species that occur both in the District and in Japan.

THE AUTHOR.

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THE BUTTERFLIES OF THE DISTRICT OF COLUMBIA AND VICINITY

By Austin H. Clark
Curator of Echinoderms, United States National Museum

INTRODUCTION

The area covered in this report includes the District of Columbia, Arlington County, and the portions of Alexandria, and Fairfax County, Va., immediately adjacent, the Potomac River Valley as far as Great Falls, and the territory east and north of Washington as far as the Eastern Branch, Beltsville, Paint Branch, Silver Spring, and Chevy Chase in Maryland. It was necessary thus to extend the limits of the area because of the obliteration within the District itself of various types of habitats presumably once supporting butterflies that are now no longer found within its borders.

COLLATERAL STUDIES

In order to provide the requisite background for the proper interpretation of the faunal relationships of the District, many trips were taken by motor to other faunal areas.

A trip was made to Norfolk, Va., and thence south along the coastal plain to Florida, the return journey being by an inland route through Berkeley, Williamsburg, Florence, and Marion Counties, S. C., and the cities of Lumberton, Fayetteville, Goldsboro, Wilson, and Rocky Mount, N. C.; thence to Petersburg and Richmond, Va.

Another trip was made to the mountain counties of central-western Virginia, and to Greenbrier, Fayette, and Kanawha Counties in West Virginia.

The counties bordering Chesapeake Bay from Calvert County in the south to Cecil County, Md., in the north were visited, and at different times all the counties of Maryland west of these to and including Washington County, as well as Chester, Lancaster, York, Adams, and Franklin Counties, Pa., were also visited.

Some years ago I spent a summer in the valleys of the Holston, Clinch, and Powell Rivers in southwestern Virginia and northeastern Tennessee, and there made a fairly large collection of the local species.

For comparison with District specimens considerable collections were made in Essex and Middlesex Counties, Mass. While the fauna of this area is more or less transitional between the Canadian fauna and the southern, material from this region is important in order to enable one fully to understand Samuel H. Scudder's descriptions of the various species. These descriptions, and his figures, were mainly, though by no means always, based upon specimens from the vicinity of Salem, Lynn, or Cambridge, Mass.

MATERIAL STUDIED

The material upon which this memoir is based consists mainly of specimens selected from many thousands collected since 1924 by my two sons, Austin B. J. Clark and Hugh Upham Clark, and by myself at all points in the District and in the adjoining territory, and of notes made during our various excursions.

In addition to this material I have been courteously permitted to study the Schönborn collection now in the United States National Museum, the Schaus collection in the same institution, the general collections of the museum, which contain many District specimens, and various smaller private collections in Washington.

Ernest Shoemaker, of Brooklyn, N. Y., was so very kind as to send me a complete list of his District butterflies.

The collection assembled by Henry F. Schönborn between 1880 and 1895 is remarkable not only for its completeness, but also for the extraordinary excellence of the specimens and the unusual skill displayed in setting them. Mr. Schönborn was especially interested in the younger stages of the Lepidoptera, and in many cases pupae, empty pupal cases, or blown larvae were preserved with the adults. It was Mr. Schönborn who first traced the life history of the orange tip (*Anthocharis genutia*). He provided W. H. Edwards with the information on this species given in his work, at the same time sending to Mrs. Mary Peart at Philadelphia the specimens from which she prepared the figures reproduced on Mr. Edwards's plates. He also sent to Mr. Edwards three nearly mature larvae of *Feniseca tarquinius* from alder, but gave him no further information in regard to them. Mr. Edwards recorded these in 1886.

Many of the specimens in Mr. Schönborn's collection, besides being absolutely perfect, are unusually large. Evidently these were raised under exceptionally favorable conditions, although this is not indicated.

No measurements of the specimens in this collection are given herein for the reason that, generally speaking, a series of raised specimens does not faithfully portray a species as it occurs in nature. Raised specimens for the most part must be interpreted as showing what a species might be were the natural conditions slightly altered.

Mr. Schönborn's collection contains representatives of 67 species from the District. In most cases there are from one to four carefully selected specimens, in a few cases more.

One species, *Polygonia progne*, is known from the District only through representation in this collection. Otto Lugger's specimen of *Vanessa j-album* from Baltimore is also included in it.

Other specimens worthy of special note are two bright, clear-yellow males of *Eurema nicippe* and an unusually large female of *Anthocharis genutia* with the tips of the wings yellowish and having more black than usual, which suggests an approach to the related *Anthocharis scolymus* of Japan and central and western China. I suspect that the latter is a raised specimen.

There is a single broken male of the orange clover (*Colias eurytheme*), which is clear evidence that Mr. Schönborn knew this only as a rare insect. None of the five specimens of the azure hairstreak (*Strymon m-album*) is perfect, indicating that he found this also rare. There are only two specimens of *Pieris protodice* and two of *Pyrgus centaureae*.

The 15 butterflies in the Schönborn collection that are accompanied by pupae or by pupal skins are:

Basilarchia arthemis astyanax.
Basilarchia archippus.
Junonia lavinia coenia.
Pyrameis virginiensis.
Vanessa antiopa.
Polygonia interrogationis.
Euphydryas phaëton.
Argynnis cybele.
Feniseca tarquinius.
Anthocharis genutia.
Papilio philenor.
Papilio cresphontes.
Papilio troilus.
Papilio marcellus.
Epargyreus tityrus.

Ernest Shoemaker's collection, the result of nearly 50 years' collecting in the District, is as interesting as that of Mr. Schönborn. It includes 63 species, four less than Mr. Schönborn's. But all except two of the species present in the Schönborn but absent from the Shoemaker collection are common forms of no special significance.

The 12 species present in the Schönborn but absent from the Shoemaker collection are:

Pyrameis virginiensis.
Vanessa antiopa.
Polygonia interrogationis.
Polygonia progne.
Danaus plexippus.
Strymon melinus.
Pieris protodice.
Papilio cresphontes.
Epargyreus tityrus.
Ancyloxypha numitor.
Hylephila phylaeus.
Prenes ocola.

The 8 species present in the Shoemaker collection but absent from the Schönborn collection are:

Strymon ontario ontario.
Strymon titus.
Cecropterus cellus.
Thanaos juvenalis.
Thanaos horatius.
Erynnis leonardus.
Atrytone vestris.
Lerema accius.

The personal investigations upon which the present memoir primarily is based have yielded a total of 85 species from the District and immediately adjacent territory, of which the following 10 seem not to have been previously taken here:

Chlorippe clyton.
Phyciodes batesii.
Brenthis myrina.
Argynnis aphrodite.
Incisalia henrici.
Erynnis sassacus.
Atrytone logan.
Atrytone pontiac.
Atrytonopsis hianna.
Poancs massasoit.

The discovery of three of these (*Brenthis myrina*, *Atrytone pontiac*, and *Poanes massasoit*) was due to the kindness of Herbert S. Barber, who pointed out to me a bog strikingly similar to the bogs in eastern Massachusetts wherein I later found them.

The 7 species known from the District that I have not been able to find are:

Polygonia progne.
Libythea bachmanii.
Strymon ontario.
Incisalia irus.
Cecropterus cellus.
Poanes viator.
Calpodes ethlius.

Harold H. Shepard, of the Bureau of Entomology, has been so kind as to give me a list of the skippers (Hesperiidae) that he has found in the District and in adjacent portions of Maryland. Those from the District are:

Epargyreus tityrus.
Thorybes pylades.
Pyrgus tessellatus.
Pholisora catullus.
Thanaos icelus.
Thanaos persius.
Thanaos juvenalis.
Ancyloxypha numitor.
? Erynnis sassacus.
Hylephila phylaeus.
Polites coras.
Polites verna.
Polites cernes.
Atalopedes campestris.

On the eastern shore of Maryland Mr. Shepard has taken in addition *Megistias fusca* and *Poanes aaroni*, as well as *Incisalia augustinus*.

One species that has not been found by Mr. Schönborn, Mr. Shoemaker, or myself is represented in the National Museum collection. This is the large and striking canna skipper (*Calpodes ethlius*), of which the museum contains five specimens collected by A. B. Duckett and the late F. H. Chittenden in Washington.

The United States National Museum, possessing the Schönborn collection and my collection, as well as many specimens presented from time to time by local entomologists, contains representatives of all the species known from the District with but two exceptions. These are *Strymon ontario ontario*, of which there is one District specimen in the American Museum of Natural History, New York City, and another in the collection of Ernest Shoemaker, in Brooklyn, N. Y.; and *Cecropterus cellus*, of which the only District specimen is in Mr. Shoemaker's collection.

The Museum of Comparative Zoology, at Harvard University, Cambridge, Mass., contains a fairly complete representation of District butterflies, and other more or less extensive series of District species are in the British Museum (Natural History), London, England; the Victoria Museum, Melbourne, Australia; the collection of the Imperial University, Kyoto, Japan; and the collection of Nagamichi Kuroda, Tokyo, Japan.

IMPORTATIONS FROM THE TROPICS

Certain tropical American butterflies have in past years been noted within the city limits of Washington, mostly about the old Center Market. As these are importations from the West Indies and Central America, with no likelihood of becoming established here, they are mere curiosities of no scientific importance. No record of them has been published and no further mention of them is made herein.

HISTORICAL

The only previous list of the butterflies of the District of Columbia was published in Paris in 1816 by David Baillie Warden, who had been on consular duty at Washington. Unfortunately, most of Mr. Warden's entomological collections had been destroyed in transit to England, and he was only able to list five species, which he said, however, were the most common. These, with the present identifications to the right, are:

Papilio cardui =*Pyrameis cardui.*
Papilio plexippus =*Danaus plexippus.*
Papilio polydamos=*Papilio troilus.*
Papilio astinous =*Papilio philenor.*
Papilio Tyrrhea =*?Epargyreus tityrus.*

In the 100 years and more that have passed since the publication of Mr. Warden's list, notices of many species taken in the District have appeared in widely scattered publications. The more important records of District butterflies are the following:

In 1862 W. H. Edwards described *Pamphila verna*=*Polites verna*, which was based partly on specimens from Washington. In 1863 he described as a new species *Hesperia wyandot*, of which one of his specimens was received from Washington. Later (1877) he found this to be synonymous with the European *centaureae.*

In 1878 Herman Strecker described as *Papilio troilus* ab. *a* an extraordinary variant "in coll. Peale." Although he did not mention the locality, the specimen was from Washington.

W. H. Edwards in 1878 published a detailed account of the life history of *Anthocharis genutia*, which was based upon specimens and notes sent to Mr. Edwards and to Mrs. Peart by Henry F. Schönborn, of Washington.

The first account of a carnivorous butterfly ever published was the partial life history of *Feniseca tarquinius*, by Prof. C. V. Riley in 1886. This was based upon notes and observations made by Th. Pergande in Washington.

In his classic work on the butterflies of the Eastern United States published in 1889, Samuel H. Scudder mentioned a number of species as having been obtained in Washington or in the District. These were the following:

Incisalia augustus =*Incisalia augustinus.*
Hesperia centaureae =*Pyrgus centaureae wyandot.*
Pontia rapae =*Pieris rapae.*
Thanaos horatius =*Thanaos horatius.*
Euphyes verna =*Polites verna.*

In 1900 Mr. Strecker redescribed Peale's specimen, together with a similar one from Allegheny County, Pa., under the name of *Papilio troilus* var. *radiatus*, and gave the locality as Washington, D. C.

In 1926 I published an article on the odors of some New England butterflies, in which I included observations made at Washington on the following species:

Junonia coenia =*Junonia lavinia coenia.*
Laertias philenor =*Papilio philenor philenor.*
Papilio glaucus =*Papilio glaucus glaucus.*
Papilio polyxenes =*Papilio polyxenes asterias.*

In this paper I also discussed the local varieties of *Junonia lavinia.*

In a general account of carnivorous butterflies published in 1926, I gave a history of the discovery of the early stages of *Feniseca tarquinius*. My observations on this species were all made about Boston, but I mentioned the effect on the emerging adults of bringing pupae from Boston to Washington.

In 1927 I published a detailed account of the life history and variations of *Euphydryas phaëton*, which was based chiefly on a large colony at Cabin John, Md., that has been since destroyed. In this paper I described as *schausi* the local form, which is readily distinguishable from the brownish form with which I was familiar in New England. I also described as *magnifica* the variant of the local form corresponding to the northern *superba*. But unfortunately the type of Drury's *phaëton* and the type of Strecker's *superba* both belong to the southern and not to the Canadian variety, so that it was the northern form that I should have named.

In 1927 I published a detailed account of the odors of butterflies in which the following species were mentioned from the District:

Eurymus philodice =*Colias philodice.*
Eurema euterpe =*Eurema lisa.*
Papilio philenor =*Papilio philenor philenor.*
Papilio glaucus =*Papilio glaucus glaucus.*
Papilio polyxenes =*Papilio polyxenes asterias.*
Papilio marcellus =*Papilio marcellus.*

In this paper the following were figured from District specimens:

Eurymus eurytheme, pl. 1, fig. 8 =*Colias eurytheme.*
Same, white female, pl. 1, fig. 9 =*Colias eurytheme.*
Anthocharis genutia, pl. 2, figs. 10, 11 =*Anthocharis genutia.*
Junonia coenia, pl. 3, fig. 25; pl. 9, fig. 43 =*Junonia lavinia coenia.*
Papilio marcellus, pl. 11, fig. 52 =*Papilio marcellus.*

In May, 1930, I published some notes on the following District butterflies:

Neonympha eurytus.
Satyrodes eurydice.
Cercyonis alope.
Euphydryas phaëton.
Brenthis myrina.
Argynnis cybele.
Colias eurytheme.
Thanaos icelus.
Thanaos juvenalis.
Erynnis leonardus.
Poanes massasoit.
Poanes hobomok.
Poanes zabulon.

In the same paper I recorded the capture of *Atrytonopsis hianna* in the District area, and gave a preliminary report on experiments in contact photographs with butterfly wings.

FORMS OF DISTRICT BUTTERFLIES

The geographical form or race in which many common butterflies occur within the District area is not quite the same as that in which they occur elsewhere. This is particularly true of butterflies ranging northward into New England and Canada, which, in a more or less narrow belt in New York and southern New England, pass over into a more or less distinct Canadian race. Compared with the local races, the Canadian races are smaller, lighter in color, with the hind wings more evenly rounded, and with less difference between the sexes.

In a discussion of the District butterflies, therefore, it is important to have a standard of comparison to which the local forms may be referred. A most excellent standard for comparison is available in the exceedingly detailed descriptions and excellent figures found in Samuel Hubbard Scudder's Butterflies of the Eastern United States and Canada with Special Reference to New England, published at Cambridge, Mass., in 1889.

The greater part of Mr. Scudder's material came from the vicinity of Salem and Cambridge, Mass. The use of his work as a standard in the present study was therefore supplemented by my assembling a collection of several thousand specimens from Manchester and Essex, Mass., near Salem, and from Newton, Mass., near Cambridge. In the course of this work some wholly unexpected captures were made, which have been recorded elsewhere. It may be remarked that it is far easier to assemble satisfactory series of local butterflies in eastern Massachusetts than it is in the vicinity of the District.

To the use of Mr. Scudder's descriptions as standards the objection might be raised that as they are based almost entirely on specimens from the transition zone between the southern and Canadian forms they represent neither the one nor the other and are therefore misleading. The answer to this is that in practically all cases the Canadian forms show a gradual change westward and especially northward from northern New England, while the southern forms similarly show a gradual change from southern New England and New York southward. Mr. Scudder's descriptions furnish a fixed point from which to work, and this is the main requisite.

Theoretically the form occurring in the type locality should be redescribed and considered as the standard for each species. But this procedure is not practicable. In a few cases the type locality is in the Canadian area, in many it is in the transition zone, and in many it is in widely varying places in the southern area. Another difficulty is that names based upon specimens from the transition zone are often of very doubtful application except as regards the species as a whole. For while some species pass by a series of minute intergradations from one geographical form to another, others do not, the northern and southern forms occurring together with few or no intergrades, or with one or perhaps two well-marked intergrading types.

Many District butterflies occur locally in two or more different forms. Eight common species have two or more broods a year with the first brood emerging from the pupae over a period of several weeks beginning very early in the spring—late in March or early in April.

These eight species are: The pearl crescent (*Phyciodes tharos*), the common blue (*Lycaenopsis argiolus pseudargiolus*), the checkered white (*Pieris protodice*), the cabbage butterfly (*Pieris rapae*), the yellow clover (*Colias philodice*), the blue swallowtail (*Papilio philenor*), the yellow swallowtail (*Papilio glaucus*), and the zebra swallowtail (*Papilio marcellus*).

All these butterflies have two different forms in spring and still a third form in summer. The earliest individuals to appear are of a distinctive type. These later are rather suddenly replaced by individuals of quite a different type. Both of these types are given forth by chrysalids—or in the case of yellow clover butterfly arise from caterpillars—that have overwintered.

In most cases the number of individuals of the early type is very small and they fly for only a short time, though the late spring form is common and is on the wing for several weeks. In some years, indeed, the early-spring form of the blue and yellow swallowtails seems to be wholly absent. On the other hand, in the case of the zebra swallowtail the early-spring form is much commoner than the later, while in the case of the common blue the early form is very common and flies for a long time, while the late-spring type is rather rare.

The two spring forms are generally quite different in their markings. In the case of the common blue, the checkered white, and the zebra swallowtail they were formerly regarded as quite different species, and in the case of the blue and yellow swallowtails they are still regarded as distinct subspecies.

The two spring forms differ not only in their color, but also more or less in habits. The early-spring form of the checkered white flies with the fairly direct and tremulous flight of the orange tip (*Anthocharis genutia*), while the late-spring form flies much more like the cabbage butterfly. The early-spring form of all the swallowtails is more restless and has a more nervous flight with more constant and more rapid wing beats than the late-spring form. The early-spring form of the pearl crescent and of the checkered and the cabbage whites keeps close to the borders of the woods, while the late-spring form, like the summer form, prefers the open fields. The early-spring form of the common blue, and of the blue, yellow, and zebra swallowtails, keeps wholly to the woods, though the late-spring form, especially of the swallowtails, is seen in open places as well as in the woods, and the summer form ranges more or less extensively over open country.

From the eggs laid by both these types develop butterflies of a third type, not so very different from the late-spring type, which is first seen in late June or July and flies throughout the summer.

If we study the characters of the three seasonal types in any of these species in detail some very interesting facts appear. In the yellow swallowtail (*Papilio glaucus*) the early-spring type is very small. The body is very hairy, and the front of the head bears a conspicuous tuft of long hairs. The dark border on the fore wings is widest at the apex and tapers posteriorly; the inclosed yellow spots are large, and on the under surface are fused into a long band tapering posteriorly. The dark border on the hind wings is very narrow; beneath it is strongly suffused with light scales and is separated from the yellow area by a regular line. The yellow submarginal lunules are much larger than they are in the summer form. The black inner or abdominal border of the hind wings is very broad.

If we compare specimens of this form with a series of yellow swallowtails from Newfoundland we find that we can not distinguish one group from the other. The form of *Papilio glaucus* that is found from Alaska and British Columbia to Newfoundland is single brooded and is recognized as a distinct subspecies under the name of *Papilio glaucus canadensis.* As early-spring individuals taken in the District of Columbia are indistinguishable from true *P. g. canadensis* (sometimes called *arcticus*), we must admit that this form is not strictly speaking a geographical race or subspecies, but simply a varietal form which represents the species throughout the area in which there is only a single brood a year, southward occurring as a progressively earlier and shorter lived spring form as far as the mountains of North Carolina, toward the southern limit of its range, as about Washington, being of irregular occurrence and not appearing every year.

In the vicinity of Washington only males of *P. g. canadensis* occur, so far as is known. Female yellow swallowtails are not to be found until the succeeding form appears. However, the fact that no females of *P. g. canadensis* have been caught or noticed does not prove that they do not exist, for in this form, in contrast to the other two forms, the sexes are practically indistinguishable on the wing.

Judging from the proportions of the sexes seen in collections, the males in Canada seem to outnumber the females about 40 to 1, though this may be due to the ease with which the males may be decoyed or baited.

A curious thing about *P. g. canadensis* as it is found in Washington is that it is fond of gathering on mud which the males of the late-spring type seem not to do.

The late-spring form is very close to the summer form, from which it differs in the direction of the early-spring form. It differs most obviously from the summer form in the slightly smaller size, the larger size of the yellow spots in the black borders of the fore and hind wings (and in the corresponding positions on the wings of the black females), and in the somewhat narrower dark border of the hind wings, especially below. There are two kinds of females, one yellow and one black. The males outnumber the females about three to one, and in life are easily distinguishable by their more erratic flight. This form is matched by summer individuals from southern New York.

In the summer form the black border on the fore wings is widest posteriorly, and the included yellow spots are very small, the lower ones being commonly obsolete; beneath they are entirely separated from each other. The dark border on the hind wings is broad, and the submarginal yellow lunules are small. Beneath there is little light suffusion, and the line separating the dark border from the yellow (or dark brown) inner portion of the wing is irregular. The black inner or abdominal border of the hind wings above is very narrow. There are at least six more or less well-marked and stable varieties of the female ranging from cream color and ochreous to black.

We see in the yellow swallowtail as it occurs about Washington precisely the same sequence of forms that occurs in the zebra swallowtail (*Papilio marcellus*). The only difference between these two insects is that throughout its range the zebra swallowtail has more than one brood and consequently is nowhere represented by the early-spring form alone.

The blue swallowtail (*Papilio philenor*) also exhibits exactly the same phenomenon. Early-spring individuals are very small, dull in color with the submarginal light spots above enlarged, and with the body clothed with long hair, which gives the insect a shaggy appearance. Late-spring individuals are of about the same size, but they are brighter in color with the light spots above less enlarged, and the hair on the body is short.

Early-spring individuals of the blue swallowtail taken about Washington are indistinguishable from the California subspecies known as *Papilio philenor hirsutus*.

The introduced western orange clover butterfly (*Colias eurytheme*) about Washington has three different forms, which, by analogy with other species, we would assume to be an early-spring form (very small, yellow faintly flushed with orange on the lower half of the fore wings, with quite different habits from the others—*ariadne*), a late-spring form (large and light orange—*keewaydin*), and a summer form (large and deep orange with a bright violet iridescence in the males—*eurytheme* or *amphidusa*). The late-spring form (*keewaydin*), however, is the first to appear, and the first brood consists wholly of this form. In the second brood the summer form (*eurytheme*) appears together with the other (*keewaydin*), and what should be the early-spring form (*ariadne*) does not appear until later, being most frequent in late August and September, when the other two forms (*keewaydin* and *eurytheme*) are both abundant. In Texas *ariadne* appears first, then *keewaydin*, and later *eurytheme*, just as the corresponding forms of *C. philodice* do here; but *ariadne* and *keewaydin* appear in successive broods, not as earlier and later individuals of the same brood as do the corresponding forms in *C. philodice*.

In addition to the group of butterflies just discussed there is another group of species having two or more broods a year, with the first brood emerging from the pupa over a short period of two or three weeks only. In these species there is only a single spring form. If it appears early, as in the case of the common copper (*Chrysophanus phlaeas hypophlaeas*), it is quite different from the summer form, corresponding to an early-spring form. But if it appears late, as in the parsnip swallowtail (*Papilio polyxenes asterias*), it is almost or quite identical with the summer form, representing a late-spring form.

Butterflies with only a single brood show the same phenomenon. Species that appear early and emerge over a long period, like the common fritillary (*Argynnis cybele*—May–October), have two forms, one smaller and duller and one, which appears later, larger and more richly colored. If they fly for only a short period in spring—a month or so—like the orange tip (*Anthocharis genutia*) or the early hairstreaks (*Incisalia augustinus*, *I. irus*, and *I. henrici*) they appear in only a single form, though the earliest individuals are smaller than those that appear later.

Butterflies with a single brood that do not appear until June or later, like the regal fritillary (*Argynnis idalia*—middle of June to October), the aphrodite (*Argynnis aphrodite*—July), the silvered bog fritillary (*Brenthis myrina*—July), the balmony butterfly (*Euphydryas phaëton*—June and early July), and Leonard's skipper (*Erynnis leonardus*—September) have only a single form, whether they emerge over a long period, like the regal fritillary, or over a short period like the others.

It may be remarked that elsewhere in its range *Argynnis aphrodite* occurs in two or more forms, and also has a longer season; in the north *Brenthis myrina* appears much earlier, has three broods, and occurs in two or more forms; and in the north *Erynnis leonardus* appears about two weeks earlier than it does in Washington.

Other District butterflies occur in three more or less well-characterized forms. A small, light-colored form is the only form found in early spring. In summer a larger and more richly colored form appears in areas with luxuriant vegetation, but is less numerous than the other. In late summer this becomes common, and a third large and very richly colored inactive form appears locally in bogs.

As an example, the common buckeye (*Junonia lavinia coenia*) in early spring is represented only by small and active light-colored individuals which have survived the winter. In midsummer there appears in meadows, usually in small numbers, a somewhat larger and less active form in which the underside of the hind wings is more or less marked with pink, usually in the form of a long and very narrow irregular triangle running downward from the anterior border toward the anal angle. In late summer this second form becomes common, and in wet localities a third very dark form appears in which the underside of the hind wings is uniform deep-pinkish red. This is far less active than the usual form, and is a poor and weak flier. Together with the intermediate form, it is wholly killed out during the winter so that in the early spring only the small and active form, which is always to be found, is seen.

The same diversity is found in the red admiral (*Pyrameis atalanta*). In early spring all the individuals are small and light colored. In early summer larger and darker individuals appear. In late summer these become common, and in addition there appears in bogs a large and very dark inactive form with the band on the fore wings narrow and more or less interrupted. This and the intermediate form disappear during the winter.

In the painted lady (*Pyrameis cardui*) all the individuals seen in early spring are small and very dull in color. In early summer the individuals are larger and more brightly colored. They are more or less divisible into two forms, one smaller and brownish red with the ground color but little variegated, and the other larger and brighter with the ground color variegated, tinged with rosy red, and with the submarginal spots on the hind wings frequently enlarged and provided with conspicuous blue centers. A single fresh individual of the small dull light-brownish early-spring form was taken on June 14, 1931, but this is the only record. In the late summer all the individuals are of the large and handsome brightly colored type, the early-spring and the intermediate forms being wholly absent. As all the individuals seen in early spring are of a form different from the single form that occurs in late summer and autumn, it is evident that this butterfly is completely killed out during the winter.

The three forms of the painted lady (*Pyrameis cardui*) obviously correspond to the three forms of the red admiral (*P. atalanta*) and of the buckeye (*Junonia lavinia coenia*); but they differ in their relative abundance. The small light-colored active form, common in all the broods of the red admiral and of the buckeye, in the painted lady is merely casual in the early-summer brood, and neither this nor the intermediate form occurs in the late-summer brood.

The two common species of *Polygonia* occurring in the District (*Polygonia interrogationis* and *P. comma*) both have a long-winged light-colored and a short-winged dark-colored form. The difference between these two forms is very marked in *P. interrogationis*, but is much less marked in *P. comma*. In both species the individuals on the wing in late summer and autumn, which live through the winter, are of the light long-winged form, and the early-summer broods are made up of individuals of the dark short-winged and relatively inactive form. But not infrequently examples of the dark form appear in late summer and live through the winter, particularly in *P. comma*, and examples of the light form are to be found in early summer, especially at the beginning of the summer brood in *P. interrogationis.*

The two local species of *Chlorippe* (*C. clyton* and *C. celtis*) both occur in a lighter and a darker form. These two forms are very distinct in *C. clyton*, but are only slightly marked in *C. celtis.* Both forms fly together, and seem to have no relation to season or to locality.

In reviewing the District butterflies we are at once struck by the fact that in no less than 12 species we find a distinctive form characterized by small size, pale or dull colors, especially a restriction of black or dark markings and an enlargement of light areas, and unusual activity. There is a second intermediate form, and a third large, richly colored, and relatively inactive form. The species in which these three forms are well marked are *Phyciodes tharos*, *Junonia lavinia coenia*, *Pyrameis atalanta*, *Pyrameis cardui*, *Lycaenopsis argiolus pseudargiolus*, *Pieris protodice*, *Pieris rapae*, *Colias philodice*, *Colias eurytheme*, *Papilio philenor*, *Papilio glaucus*, and *Papilio marcellus.*

In all these species, with the single exception of *Colias eurytheme*, these forms occur in the same sequence, first the smallest and dullest, then the intermediate, and lastly the largest and most richly colored. In *Colias eurytheme*, which here is an intrusive species, this same sequence is found in other regions.

In *Phyciodes tharos*, *Lycaenopsis argiolus pseudargiolus*, *Pieris protodice*, *P. rapae*, *Colias philodice*, *Papilio philenor*, *P. glaucus*, and *P. marcellus* the small light form is normally confined to more or fewer of the earlier individuals of the spring brood, the later individuals of the same brood being of the intermediate form.

In *Junonia lavinia coenia*, *Pyrameis atalanta*, and *P. cardui* all the individuals of the brood which flies in spring are of this form. In *Pyrameis cardui*, as it is found in the District, the early-summer brood is made up of the intermediate and the richly colored form, and the late-summer brood consists wholly of the latter. In *Junonia lavinia coenia* and in *Pyrameis atalanta* the small dull form is joined in summer by the intermediate form, and in late summer both forms are joined by the dark, inactive form, all three forms flying together.

In addition to the butterflies in which there are three well-marked forms there are several others in which there are two distinct forms, sometimes with traces of a third. In *Chrysophanus phlaeas hypophlaeas* there is a well-marked early-spring form, and the first individuals of the second brood are not infrequently more or less intermediate between this and the summer form. *Papilio polyxenes asterias* does not fly until after the early-spring forms in the other swallowtails have disappeared, so that an early-spring form is not to be expected in this species. The two forms of *Argynnis cybele* seem to correspond to a late-spring and a summer form. The two forms of *Polygonia interrogationis* and *P. comma* seem to correspond to an early-spring and summer form. In both these species occasional individuals occur with the wing shape of the light form but intermediate in color between the extreme light and the dark forms.

How are these various forms to be interpreted? In the swallowtails the early-spring form when typically developed has the hair on the body very long, so that the insect appears shaggy, and a tuft of long hairs on the front of the head. Most light-colored butterflies caught in March and early April show a more or less heavy infuscation on the lower surface of the hind wing and at the bases of the wings above. Development of long hair on the body and a general infuscation are characteristics of Arctic and Alpine butterflies, and so may reasonably be attributed to the direct effect of cold. But our early-spring forms sometimes lack the long hair, and also may show no trace of any infuscation. This is especially true when they appear in autumn. Furthermore, at the end of the season large individuals of the summer form of the pierids occur with a heavy infuscation. Thus the long hair and the general infuscation, while common attributes of early-spring forms, appear to be secondary features superposed by cold upon a form which occurs normally in cold weather but which is primarily a response to conditions other than those directly produced by cold.

In the case of *Junonia lavinia coenia* the differences between the small, light, and active and the large, dark, and inactive forms are essentially the same as those between the so-called dry-season and wet-season forms of the Asiatic *Junonia orithya*, *J. almana*, and *J. iphita*. We seem to be justified, therefore, in considering the bog-living form of the buckeye as a true wet form, corresponding exactly to the wet forms of its Old World relatives. It arises from eggs laid by the dry form, just as they do. It agrees with them in occurring only at a certain season. It differs from them only in being very local, in occurring together with the other forms and with intermediates, and in leaving no descendants. The case is somewhat similar to that of *Papilio glaucus canadensis*, which is the only form of *P. glaucus* occurring where it is single brooded, but which in the District appears only as the earliest individuals of the first brood.

If the large dark and inactive form of the buckeye can be interpreted as a wet form and the small light active form as a dry form, and if the three forms of this butterfly can be considered as corresponding to the similar three forms of other District species, it follows that the summer forms of the local species are in reality wet forms, and the early-spring and comparable forms are primarily dry forms, usually showing to a greater or lesser degree the influence of cold.

Spring and autumn are seasons of cool nights and warm or even hot days. The heating of the air during the day reduces the amount of contained water vapor far below the saturation point. This might be expected to result in the appearance of dry butterflies resembling those appearing in subarctic regions under essentially the same conditions, and corresponding to others appearing in unusually dry summers or in unusually dry regions.

In addition to these normal forms of butterflies, individuals occur in every species which are more or less widely different from the usual type. These so-called aberrations may be quite erratic, or they may appear more or less regularly. Very few of them have been found in the District; of those which are known from this region the two most noteworthy are *Papilio troilus* ab. *radiatus* and *Euphydryas phaëton* ab. *superbus*.

From time to time butterflies are found in which both sexes are combined in a single individual. One side may be male and the other female, as in a specimen of *Atalopedes campestris* recorded and figured herein (pl. 16, fig. 3), or the two sexes may be mixed in a more or less haphazard way; for instance, one or more of the wings may show patches of both the male and female color pattern.

It has become rather a popular diversion to bestow special names on the various forms of each butterfly, and even upon the aberrations. I can not see that this procedure helps in any way to clarify the subject—on the contrary, it often tends to obscure it. For instance, the yellow swallowtail (*Papilio glaucus*) is usually supposed to have one yellow and one black female form, chiefly because one of the yellow and one of the black female forms have received names. As a matter of fact, it has a whole series of female forms ranging from cream-white to black, while the spring black female is distinguishable at a glance from the summer black female. Some of these female forms are stable and some are very variable, intergrading imperceptibly into others. Giving names to them implies a certain fixity of type that in reality does not exist and therefore conveys a false idea of their significance.

In the following pages wherever special names have been given to seasonal or other forms they are usually mentioned, but no new names are applied, and no new names are given to aberrations.

NOMENCLATURE

In a preliminary list of the butterflies of the District published in connection with the present memoir, the nomenclature adopted was that used in a list of North American Lepidoptera recently published by William Barnes and Foster H. Benjamin.

Some of the many changes in the nomenclature of the butterflies occurring in the District which are included in this list are from the strictly technical viewpoint thoroughly justified, while others are based upon rather dubious premises.

But whatever the status of the more or less unfamiliar names may be the fact remains that radical innovations in nomenclature, whether justified or not, are wholly out of place in a local list. The object of a local list is to make clear the relation of the local fauna to the fauna of the larger area of which the region considered is a part. This can be done only if in the local list a system of nomenclature is used which is in general agreement with the nomenclature employed in similar lists covering other areas and in addition is generally familiar to the students of North American butterflies as a whole.

The names used herein are therefore those most commonly employed for the genera and species concerned both in this country and elsewhere. Whether or not they are strictly correct from the standpoint of a strict application of the rules of the International Code of Nomenclature is of less importance than that they shall be intelligible to the maximum number of the students of the Lepidoptera.

But in most cases these names are quite correct. Prof. William T. M. Forbes, of Cornell University, Ithaca, N. Y., was so very kind as to pass judgment on all the names used herein, and several of them are used at his suggestion. I am also much indebted to Dr. W. J. Holland, director (emeritus) of the Carnegie Museum, Pittsburgh, Pa., for clearing up several dubious points.

FAUNAL RELATIONS OF THE DISTRICT

The District of Columbia lies across the fall line or line of demarcation between the coastal plain and the rolling piedmont region. But in the District the coastal plain is represented by a long and relatively narrow northwesterly extension into the piedmont, which forms the lower portion of the valley of the Potomac.

Scarcely 30 miles northwest of the District the land begins to rise into the eastern ridges of the Appalachians, and from the mountains there is a short and fairly direct connection with the District down the valley of the Potomac.

As would be expected from its proximity to the Appalachians, along which many northern butterflies extend southward to southwestern Virginia and southern West Virginia or western North Carolina, some even as far as northwestern South Carolina or northern Georgia, the fauna of the District is distinctly northern in its general aspect. In the District no less than 14 northern butterflies reach their extreme southern limit at sea level. These are as follows:

Satyrodes eurydice.
Cercyonis alope maritima.
Euphydryas phaëton.
Brenthis myrina.
Polygonia progne.
Argynnis aphrodite.
Strymon ontario ontario.
Incisalia augustinus.
Pyrgus centaureae.
Erynnis sassacus.
Atrytone pontiac.
Atrytone logan.
Poanes massasoit.
Atrytonopsis hianna.

Some of these are not known from farther south, but most of them range southwestward along or in the mountains to southwestern Virginia or beyond.

Whereas butterflies which in the north are generally distributed become restricted south of the District to the mountains, butterflies which are generally distributed in the south tend toward the north to become more and more closely restricted to the coastal plain, along which they extend northward into New Jersey, New York, and even southern New England, and some of them also along both shores of Chesapeake Bay to Baltimore or beyond.

Thus there are recorded from the coast of New Jersey in the vicinity of Cape May such southern species as *Neonympha phocion*, *Cercyonis alope pegala*, *Dione vanillae*, *Atlides halesus*, *Strymon favonius*, *Goniurus proteus*, *Prenes panoquin*, and *Atrytone dion*, which do not occur in the vicinity of the District. *Enodia portlandia*, which is generally distributed in North Carolina and in southern Virginia, also occurs in this region, though not in the District. It is interesting to note that in the region of Cape May these southern species are found together with such characteristically northern forms as *Brenthis myrina*, *B. bellona*, *Satyrodes eurydice*, and *Strymon liparops*.

The relation of the District to the coastal plain is made clear by observing the active and conspicuous *Phoebis eubule* and the scarcely less noticeable *Eurema nicippe*. Both of these butterflies are readily identified from a moving automobile. They are very common in all the counties of Maryland bordering Chesapeake Bay, where they are constantly seen along the sides of the road and in the fields. West of the Patuxent River they rapidly become less common, and they disappear sometime before the District line is reached. North of the District they extend farther inland and are common, or at least frequent, in the lower lands of Howard, Frederick, and Carroll Counties, Md., and northeastward into Pennsylvania. Both species are also common in the Maryland and Virginia counties along the lower Potomac, and they are frequent as near the District as Alexandria and Falls Church, Va.

In connection with the fauna of the coastal plain two other butterflies call for special notice. Neither of these winters over in the District, both of them arriving early in spring from the Chesapeake Bay region or the lower Potomac, living here throughout the summer, and completely dying out during winter.

The common milkweed butterfly (*Danaus plexippus*) is always to be found in summer in the District, but it is seldom very common; it is never the conspicuous element in the fauna here that it is in the fauna of the territory about Chesapeake Bay or about the broad reaches of the lower Potomac. The painted lady (*Pyrameis cardui*) is usually present in the District during summer; it is occasionally abundant, but in some years is wholly absent.

In the mountains southwest of the District there are several species which have a more or less extensive range southwestward or westward but do not occur on the Atlantic watershed east of the bases of the mountains. At the present time these scarcely call for consideration in connection with the District fauna, but some of them are common not very far away and are to be looked for as casuals or as temporary residents.

The District possesses a single butterfly, *Poanes massasoit hughi*, that is not known from any other region. Two other singularly local skippers occur not far away. *Poanes aaroni aaroni* is common in the salt marshes of southern New Jersey and has been taken on the eastern shore of Maryland, and *Amblyscirtes carolina* is known only from the southeastern to east-central part of North Carolina, and southeastern Virginia.

In summing up the faunal relations of the District, it may be said that the fauna of the District is for the most part composed of butterflies that range very widely over eastern North America. As the District lies just on the eastern border of the southern extension of the range of many northern species, its fauna includes a number of characteristically northern forms which give it a predominantly northern aspect. Such southern species as extend far northward mostly pass by the District area to the east in the region of the coastal plain, and the few that reach the District are less numerous in individuals and less faunally diagnostic than the northern species. The southern Appalachian species are represented only by casual individuals.

RELATIVE OCCURRENCE AND HABITATS

The relative proportions of the several groups of butterflies found in the District are shown in Table 1. For a list of the District butterflies, see Table of Contents, pages v–viii.

TABLE 1.—*Relative occurrence of families and subfamilies of butterflies in the District of Columbia*

Group	Number of species		Per cent	
Nymphalidae	26		28.26	
Satyrinae		4		4.35
Nymphalinae		20		21.74
Danainae		1		1.09
Libytheinae		1		1.09
Lycaenidae	14		15.22	
Gerydinae		1		1.09
Lycaeninae		3		3.26
Theclinae		10		10.87
Papilionidae	15		16.30	
Pierinae		8		8.69
Papilioninae		7		7.61
Hesperiidae	37		40.22	
Pyrginae		14		15.22
Hesperiinae		23		25.00
Total	92	92	100.00	100.00

Compared with the corresponding figures for all the species of eastern North America, exclusive of the Gulf coast and southern Florida, the Hesperiidae (skippers) are seen to be nearly 10 per cent more numerous (40.2 as against 30.3 per cent); the Papilionidae (swallowtails and pierids) are found to be slightly less numerous (16.3 and 17.4 per cent); the Lycaenidae (coppers, blues, and hairstreaks) are fewer (15.2 and 20.8 per cent), and the Nymphalidae are also somewhat fewer (28.2 and 31.4 per cent).

The figures given for the Papilionidae scarcely represent the true conditions. Three species (*Pieris protodice*, *Papilio cresphontes*, and *Papilio marcellus*) have almost completely disappeared; two others are immigrants, one (*Pieris rapae*) from Europe and the other (*Colias eurytheme*) from the Southwest; and a sixth (*Phoebis eubule*) is only a casual visitor. Subtracting the two immigrants and the casual visitor, the number of Papilionidae in the District is reduced to 12, and the percentage to 13, which is considerably less than the normal (17.4 per cent).

The marked preponderance of skippers, especially when taken in connection with the fact that several species which should occur here have not as yet been reported, suggests that the present fauna of the District is one from which various elements have disappeared through the clearing of the land and resultant changes. Changes in conditions arising from the clearing of the land affect skippers less than they do other butterflies, because of their small size and also because of the fact that all of them in this general region feed either on grasses or on other very common plants.

The 92 species and subspecies of butterflies known from the District may be classified as follows according to residence:

PERMANENT RESIDENTS (72)

Neonympha eurytus.
Satyrodes eurydice.
Cercyonis alope alope.
Cercyonis alope maritima.
Chlorippe celtis.
Chlorippe clyton.
Basilarchia arthemis.
Basilarchia archippus.
Junonia lavinia.
Pyrameis atalanta.
Pyrameis virginiensis.
Vanessa antiopa.
Polygonia interrogationis.
Polygonia comma.
Phyciodes tharos.
Phyciodes batesii.
Euphydryas phaëton.
Brenthis myrina.
Argynnis idalia.
Argynnis cybele.
Euptoieta claudia.
Libythea bachmanii.
Chrysophanus phlaeas.
Anthocharis genutia.
Papilio philenor.
Papilio troilus troilus.
Papilio glaucus.
Papilio polyxenes.
Epargyreus tityrus.
Achalarus lyciades.
Thorybes pylades.
Thorybes daunus.
Pyrgus centaureae.
Pyrgus tessellatus.
Pholisora catullus.
Thanaos icelus.
Thanaos brizo.
Thanaos persius.
Thanaos martialis.
Thanaos juvenalis.
Thanaos horatius.
Ancyloxypha numitor.
Erynnis leonardus.
Hylephila phylaeus.
Polites coras.
Polites verna.
Feniseca tarquinius.
Everes comyntas.
Lycaenopsis argiolus.
Strymon melinus.
Strymon titus.
Strymon calanus.
Mitoura gryneus.
Incisalia irus.
Incisalia augustinus.
Incisalia henrici.
Incisalia niphon.
Eurema nicippe.
Eurema lisa.
Colias philodice.
Polites manataaqua.
Polites cernes.
Atalopedes campestris.
Catia otho.
Atrytone logan.
Atrytone vestris.
Atrytone pontiac.
Poanes massasoit.
Poanes hobomok.
Poanes zabulon.
Amblyscirtes vialis.
Megistias fusca.

REGULAR SUMMER RESIDENT (1)

Danaus plexippus

INTERMITTENT RESIDENTS (4)

Pyrameis cardui.
Strymon m-album.
Pieris protodice.
Papilio cresphontes.

INTRODUCED SPECIES (2)

Colias eurytheme.
Pieris rapae.

CASUALS (13)

Argynnis aphrodite.
Polygonia progne.
Strymon ontario.
Phoebis eubule.
Papilio marcellus.
Papilio troilus ilioneus.
Cecropterus cellus.
Erynnis sassacus.
Atrytonopsis hianna.
Poanes viator.
Lerema accius.
Prenes ocola.
Calpodes ethlius.

The butterflies listed as casuals should perhaps be described as of undetermined status. *Papilio marcellus* was common locally in the District area up to about 20 years ago and frequent up to 4 or 5 years ago. It has now almost completely disappeared. It is still to be found as a rather frequent butterfly early in spring in the region between Cabin John and Great Falls, Md., but it disappears from this section during summer.

Polygonia progne, *Strymon ontario*, *Erynnis sassacus*, *Atrytonopsis hianna*, and *Poanes viator* are all known from single occurrences. All of them are northern, or at least range far to the northward of the District. They are either intruders from the mountainous country to the northwest or, which seems to me more likely, species which are disappearing from this region. The same may be said of *Argynnis aphrodite*, *Incisalia augustinus*, and *Lerema accius*. The first of these is known from three specimens, the second from two, and the third from several. *Cecropterus cellus*, *Prenes ocola*, and *Calpodes ethlius* are southern species which might be expected here. But I suspect that the last, and possibly the last two, are from time to time introduced on plants. *Papilio troilus ilioneus* may be simply a variant from *Papilio troilus troilus* parents. The appearance of more or less typical representatives of unexpected forms in this manner is not unusual.

One of the most curious phenomena connected with the local butterflies is the production by three species in the late-summer broods of highly colored " wet " forms, which, so far as is known, are always killed off during the winter, only the " dry " forms surviving. These three species are: *Junonia lavinia*, *Pyrameis atalanta*, and *Pyrameis cardui.*

The District butterflies that are sufficiently known locally may be classified according to their several types of habitat as follows:

OCCURRING GENERALLY IN OPEN COUNTRY

Basilarchia archippus.
Junonia lavinia.
Pyrameis virginiensis.
Pyrameis eardui.
Phyciodes tharos.
Phyciodes batesii.
Danaus plexippus.
Everes comyntas.
Strymon melinus.
Strymon m-album.

Eurema lisa.
Colias philodice.
Colias eurytheme.
Pieris rapae.
Pieris protodice.
Papilio cresphontes.
Papilio polyxenes.
Achalarus lyciades.
Pyrgus tessellatus.
Hylephila phylaeus.
Polites coras.
Polites manataaqua.
Atalopedes campestris.
Catia otho.
Atrytone vestris.
Atrytonopsis hianna.
Megistias fusca.
Lerema accius.

OCCURRING GENERALLY IN WOODS

Neonympha eurytus.
Basilarchia arthemis.
Vanessa antiopa.
Polygonia interrogationis.
Polygonia comma.
Pyrgus centaureae.
Thanaos brizo.
Thanaos persius.
Thanaos martialis.

OCCURRING BOTH IN WOODS AND IN OPEN COUNTRY

Pyrameis atalanta.
Papilio philenor.
Papilio glaucus.
Papilio troilus.
Papilio marcellus.
Thanaos icelus.
Thanaos juvenalis.
Epargyreus tityrus.
Thorybes pylades.
Thorybes daunus.

OCCURRING IN WET GRASSY AREAS IN AND NEAR WOODS

Polites verna.
Atrytone logan.
Poanes hobomok.
Poanes zabulon.
Amblyscirtes vialis.

OCCURRING GENERALLY IN WET FIELDS

Argynnis idalia.
Euptoieta claudia.
Eurema nicippe.
Ancyloxypha numitor.
Erynnis leonardus.

FOUND IN WET OPEN LANDS AND WET WOODS

Argynnis cybele.
Argynnis aphrodite.
Strymon titus.
Strymon calanus.

FOUND IN WET FIELDS IN OR NEAR WOODS, WITH SPIRAEA LATIFOLIA AND SANGUISORBA CANADENSIS

Satyrodes eurydice.
Brenthis myrina.
Atrytone pontiac.
Poanes massasoit.

FOUND IN CULTIVATED GROUND, IN BARREN FIELDS, AND ALONG ROADSIDES

Chrysophanus phlaeas.
Pholisora catullus.

FOUND ONLY NEAR THE FOOD OF THE LARVAE

Chlorippe celtis.
Chlorippe clyton.
Euphydryas phaëton.
Libythea bachmanii.
Feniseca tarquinius.
Mitoura gryneus.
Anthocharis genutia.

OCCURRING IN WOODS WITH PINES, AND ADJACENT GRASS LANDS

Cercyonis alope

FOUND IN AND NEAR WOODS WITH PINES

Incisalia niphon

FOUND IN AND NEAR DAMP WOODS WITH SPHAGNUM AND VACCINIUM

Incisalia augustinus.
Incisalia henrici.

OCCURRING IN SCRUBBY LAND AND GARDENS

Incisalia irus

OCCURRING IN BUSHY MEADOWS AND VERY OPEN WOODS

Lycaenopsis argiolus

This classification of the local butterflies by types of habitat is in certain cases only approximate.

Most butterflies wander more or less, and stray individuals are sometimes taken far from their normal territory. Woodland butterflies will travel long distances over open fields, usually flying high in a perfectly straight line, and the butterflies of open country will often deeply penetrate the woods along the roads.

It is usually the case in butterflies having two or more broods that the more numerous individuals of the later broods cover a broader area than the relatively few individuals of the first brood. Thus the least skipper (*Ancyloxypha numitor*) in spring is confined to wet grassy regions in the immediate vicinity of small running streams and is so sharply localized that it is quite likely to be overlooked. The next brood covers a much increased territory, while in the middle of September this little skipper is to be found, in greater or lesser numbers, in all grassy regions and even in the city parks.

In the same way the viceroy (*Basilarchia archippus*) early in spring is confined to wet meadows with willow bushes or to hillsides with a growth of small poplars, but in the middle of September it is found throughout the open country, especially along roadsides.

While in the spring the various swallowtails keep rather strictly within their proper habitats, in September they are all to be found covering much the same territory. This is not true, however, for the zebra swallowtail (*Papilio marcellus*), which early in spring is far more widely scattered than at any other time, and wholly disappears toward the end of August.

The painted lady (*Pyrameis cardui*) when scarce and even when rather common is found in the same habitat as the American painted lady (*P. virginiensis*), but when abundant it becomes frequent in the woods and common about gardens in the city.

GENERAL FEATURES OF THE DISTRICT FAUNA

Perhaps the most characteristic feature of this area is the great abundance of large swallowtails. Especially late in summer these conspicuous insects attract the attention of even the most casual observer. It was probably this feature that led some of the early writers who mentioned the natural history of this region to remark particularly on the number and beauty of the butterflies. As these writers came from England, where there is only a single rather small native swallowtail (*Papilio machaon brittanicus*), which has a restricted range and is not very common, with a second, the "scarce swallowtail" (*Papilio podalirius*), as a casual visitor from Europe, they would naturally be amazed at the abundance and variety of these insects here.

But broadly speaking the District and the surrounding country is a poor region for butterflies. Few kinds are really abundant, and a number are very local, being found only in a few widely separated stations or only in a single place.

I know of no other region where butterflies are so scarce in spring as they are in the District and in its immediate vicinity. The mortality during the winter months is here evidently considerably in excess of what it is elsewhere. The reason for this is probably to be found in the alternate freezing and thawing during winter, the severe cold waves which occur almost every winter, and the severe hot spells characteristic of spring.

The scarcity of many species in spring, however, is due not so much to the fewness of the individuals as to the fact that the emergence of the spring brood is much prolonged and extends over a period of several weeks, so that only a small proportion of the total number of spring individuals is on the wing at any one time. Elsewhere, particularly in the north, the individuals of the spring brood of these same butterflies all emerge within a relatively short time, so that the species appear to be much more common than they are here.

In the following lists the local butterflies are classified on the basis of their relative abundance. Those butterflies are listed as abundant of which more than 15 may be taken in an average day's collecting; common butterflies are those of which from 6 to 15 may usually be taken in a day; frequent butterflies are those which can always be found, but of which an average of less than 6 will be taken in a day; and rare butterflies are such as are taken not more than once or twice in a season.

ABUNDANT

Junonia lavinia (occasionally).
Pyrameis cardui (occasionally).
Phyciodes tharos.
Danaus plexippus (occasionally).
Everes comyntas.
Eurema lisa.

Colias eurytheme.
Colias philodice.
Papilio philenor.
Papilio troilus.
Papilio polyxenes.
Epargyreus tityrus.
Thorybes pylades.
Thorybes daunus.
Ancyloxypha numitor.
Polites coras.
Polites cernes.
Atalopedes campestris.

COMMON

Basilarchia archippus.
Junonia lavinia (usually).
Pyrameis cardui (occasionally).
Danaus plexippus (rarely).
Argynnis cybele.
Strymon melinus.
Pieris rapae.
Papilio glaucus.
Pholisora catullus.
Thanaos icelus.
Thanaos persius.
Thanaos martialis.
Thanaos juvenalis.
Thanaos horatius.
Polites verna.
Catia otho.
Atrytone vestris.
Megistias fusca.

FREQUENT

Neonympha eurytus.
Cercyonis alope.
Basilarchia arthemis.
Pyrameis atalanta.
Pyrameis virginiensis.
Vanessa antiopa.
Polygonia interrogationis.
Polygonia comma.
Argynnis idalia.
Euptoieta claudia.
Danaus plexippus (usually).
Chrysophanus phlaeas.
Lycaenopsis argiolus.
Strymon m-album.
Incisalia niphon.
Anthocharis genutia.
Achalarus lyciades.
Pyrgus tessellatus.
Thanaos brizo.
Erynnis leonardus.
Hylephila phylaeus.
Poanes zabulon.
Amblyscirtes vialis.

COMMON IN VERY RESTRICTED LOCALITIES

Satyrodes eurydice.
Chlorippe celtis.
Euphydryas phaëton.
Brenthis myrina.
Libythea bachmanii.
Feniseca tarquinius.
Mitoura gryneus.
Incisalia augustinus.
Incisalia henrici.
Incisalia irus.
Eurema nicippe.
Atrytone pontiac.
Poanes massasoit.

RARE

Chlorippe clyton.
Polygonia progne.
Phyciodes batesii.
Argynnis aphrodite.
Strymon ontario.
Strymon titus.
Strymon calanus.
Phoebis eubule.
Pieris protodice.
Papilio cresphontes.
Papilio marcellus.
Cecropterus cellus.
Pyrgus centaureae.
Erynnis sassacus.
Polites manataaqua.
Atrytone logan.
Poanes viator.
Poanes hobomok.
Atrytonopsis hianna.
Lerema accius.
Prenes ocola.

THE OCCURRENCE OF BUTTERFLIES IN THE DISTRICT OF COLUMBIA

The butterflies of the District are to be seen in the greatest diversity and profusion late in summer. The locality where they may be observed to best advantage is the long meadow between the Conduit Road and the canal, 2 miles west of Cabin John, Md.

Here in the second week in September the thistles are in full bloom and the joe-pye-weed, the boneset, the goldenrods, and certain small asters and leguminous plants are flowering profusely. In these fields the pink gerardia (*Agalinis purpurea*) is exceedingly abundant, and its lovely flowers impart a hazy flush of pink to the lower herbage over extensive areas.

Most conspicuous of the butterflies in this area is the blue swallowtail (*Papilio philenor*), which is visible on every side, dashing from side to side and up and down and often doubling on its course with its characteristic wild impetuous flight. Less numerous, but still common, is the parsnip swallowtail (*Papilio polyxenes*). This has a less impetuous and less irregular, though nervously active, flight, but on flowers it is wary and suspicious and more difficult to capture than the other. About as numerous as the parsnip swallowtail is the spice-bush swallowtail (*Papilio troilus*), which is at once distinguished from the others by the less hurried flight and the somewhat slower motion of the wings. It flies at about the height of the majority of the thistle flowers—that is, about 5 feet above the ground—higher than the parsnip swallowtail and lower than the upward, though higher than the downward, dashes of the blue. From time to time, straying from the woods adjacent, the yellow swallowtail appears, its leisurely deportment and deliberate flight contrasting sharply with the actions of the other species.

Early in the morning these swallowtails may be seen sunning themselves on the leaves of bushes or on grass blades. They soon begin to course about, dotting the fields on every side. After the middle of the morning their exertions begin to tell on them, and in increasing numbers they begin to feed upon the thistle flowers. Early in the afternoon they are mainly occupied in feeding, flying from one flower to another. After the middle of the afternoon their numbers gradually decrease, each kind returning to its proper habitat, the parsnip to the grassy fields, the others to the woods.

After the swallowtails the most conspicuous butterfly on the thistle flowers is the milkweed butterfly, or monarch (*Danaus plexippus*), of which several are to be seen at any time of day. These feed from early morning to late afternoon, and, when resting on the flowers with the wings closed above the back, are singularly unsuspicious and with due caution may be captured with the fingers.

Very common on the thistles is the silver-spotted skipper (*Epargyreus tityrus*), less common and much less readily perceived the sachem (*Atalopedes campestris*). Next commonest are the yellow and the orange clover butterflies (*Colias philodice* and *C. eurytheme*), and two or three species of the smaller skippers. From time to time one sees a Leonard's skipper (*Erynnis leonardus*), conspicuous because of its large size and the bright rusty under surface of the wings. This skipper is not common, and you will not see more than two or three in the course of an entire day. Even less frequent is the American painted lady (*Pyrameis virginiensis*), but this becomes common later in the season.

Scattered everywhere about the fields are the clover butterflies, the yellow (*Colias philodice*) outnumbering the orange (*C. eurytheme*) about three to one. The white butterflies, which are fairly numerous, aggregating about one-fourth of all the butterflies of this type, are the white females of these species, nearly all of them of the yellow one, which are easily distinguished from the infrequent cabbage butterfly (*Pieris rapae*) by their stronger, less meandering, and more rapid flight.

Here and there are seen quite commonly small yellow butterflies (*Eurema lisa*) with a low, weak, wandering flight. They are more numerous along the roads and where the grass is short than elsewhere. Some of these are almost white, while others are of a brilliant yellow.

More numerous than these, though less conspicuous because of their small size and brownish coloration, are the pearl crescents (*Phyciodes tharos*) and the tailed blues (*Everes comyntas*), which are everywhere to be seen flying near the ground. Together with these, in somewhat lesser numbers, are the least skipper (*Ancyloxypha numitor*), mostly seen dancing lazily among the grass blades, and another skipper almost as small (*Polites coras*), usually to be observed on small flowers near the ground.

From time to time worn and battered females of the cybele (*Argynnis cybele*) are seen cruising about the fields hunting for violets on which to lay their eggs. Occasionally they descend and hover near the grass tops for a second or two, soon rising and going on their way. Sometimes, though rarely, they will visit thistle flowers. A few of these cybeles are fresh and brightly colored, though always with torn wings, and these are more often to be seen on flowers. There frequently appear the females of the regal fritillary (*Argynnis idalia*), which every 100 feet or so suddenly drop like lead into the grass where they walk about for several minutes depositing their eggs. These, though rubbed and faded, are much less dilapidated than most of the females of the cybele, and none of them are fresh or brightly colored. A few of the males of the regal fritillary still are about and may be seen on the thistle flowers. They are so worn as scarcely to be recognizable, but they are wary and as alert as ever.

Along the open roads running through these fields the viceroy (*Basilarchia archippus*) is common, flying back and forth or perched on the bare ground enjoying the hot sun. If startled it circles about over the fields, but soon returns, being, wherever it occurs, primarily a roadside butterfly. The buckeye (*Junonia lavinia*) is also common on the roads, but only occasional in the fields. It, too, is by preference a roadside butterfly.

On the muddy spots in the open roads sit little mixed companies composed of the males of the yellow clover butterfly (*Colias philodice*) and of the lesser sulphur (*Eurema lisa*), in varying proportions. The members of each little company sit very close together. If a dead yellow butterfly or a bit of yellow paper be dropped upon the mud, another little company soon will form about it. Scattered widely over the surface of the mud and paying no attention to each other are numerous pearl crescents (*Phyciodes tharos*), several tailed blues (*Everes comyntas*), and a few skippers, often the silver-spotted skipper (*Epargyreus tityrus*) and sometimes a sooty skipper (*Pholisora catullus*) or a dusky wing (*Thorybes daunus*), or even a gray darter (*Pyrgus tessellatus*).

Along the borders of the woods the common blue (*Lycaenopsis argiolus*) is seen flying near or among the trees, often rising to a considerable height above the ground, while the hop merchant (*Polygonia comma*) and the question mark (*Polygonia interrogationis*) and more rarely the Camberwell beauty (*Vanessa antiopa*) sun themselves on the leaves of bushes or the lower branches of the trees, or play about in the mottled shade. It is interesting to observe in the case of the hop merchant and the question mark (*Polygonia comma* and *P. interrogationis*) that some of the individuals are very worn and faded, while others are quite fresh. In the worn ones the ground color of the hind wings is dark, in the fresh ones light.

In a small grove bordering the fields in this vicinity the hackberry butterfly (*Chlorippe celtis*) and the tawny emperor (*Chlorippe clyton*) are to be seen in numbers, mostly about the higher branches of the trees, while nearer the ground the hop merchant and the question mark are common.

In the boggy portions of the fields, but not elsewhere, the variegated fritillary (*Euptoieta claudia*) is not uncommon.

In certain places by the roadside the pigweed (*Chenopodium album*) is a common plant, and an examination will reveal numbers of the little caterpillars of the sooty skipper (*Pholisora catullus*), each in a little shelter made by rolling inward and fastening together the borders of a leaf. The abundance of these caterpillars is extraordinary in view of the relative scarcity of the butterfly. On the isolated willow bushes in the fields are many of the caterpillars of the viceroy (*Basilarchia archippus*) in every stage of growth, while an examination of the sassafras and the tuliptrees will disclose the caterpillars of the spicebush swallowtail (*Papilio troilus*), known locally as "mellow bugs."

The preceding sketch represents conditions that prevailed in the middle of September, 1928. But the picture constantly is changing and is never quite the same in different years.

In the same fields at the same time of year in 1925 the orange clover butterfly (*Colias eurytheme*) was very scarce, and only one or two were to be seen during the course of an entire day. On the other hand, the cabbage butterfly (*Pieris rapae*) was rather common, and the checkered white (*Pieris protodice*) occurred, though in small numbers. The nicippe (*Eurema nicippe*) was occasionally seen, and the painted lady (*Pyrameis cardui*) was frequent on the thistle flowers. This last seemed to be wholly absent from the District in 1928.

But the most extraordinary difference between 1925 and 1928 was the great abundance in the former year and complete absence in the latter of the large dark form of the common buckeye (*Junonia lavinia*), the caterpillars of which were to be found in numbers on the pink gerardia (*Agalinis purpurea*).

In the middle of September in 1926 the eubule (*Phoebis eubule*) was here occasionally seen flying high and with great speed from west to east, and we took specimens of the azure (*Strymon m-album*) and the gray (*Strymon melinus*) hairstreaks. In that year also the yellow swallowtail (*Papilio glaucus*) was very common.

Earlier in the season in these fields and in the woods adjacent several other butterflies are common. In May the pretty little orange tip (*Anthocharis genutia*) flutters about the open woods between the fields and the canal, and in the open places in these woods and especially along the roads are found the dusky skippers (species of *Thanaos* and *Thorybes*). In June and July in these same woods the wood nymph (*Neonympha eurytus*) is often seen (it is common in some places). From the middle of June to the middle of July about patches of white turtlehead (*Chelone glabra*) growing in a boggy hollow and along a ditch in the open fields the turtlehead butterfly (*Euphydryas phaëton*) formerly was very common, and its conspicuous caterpillars quite abundant. But in 1927 it had greatly decreased in numbers, and none were found in 1928 or 1929, though it reappeared in 1930 and 1931. From the middle of July until about the end of August the goggle eye (*Cercyonis alope*) is sometimes to be seen along the borders of the woods, but it is scarce and very shy. In midsummer the red admiral (*Pyrameis atalanta*) was until recent years a very common butterfly in boggy spots, and its caterpillars occurred abundantly on the false nettle (*Boehmeria cylindrica*); but it was scarce in 1927 and 1928. From early in May until well into August in these fields and throughout the woods adjacent the zebra swallowtail (*Papilio marcellus*) is not at all uncommon, and its eggs are often found on the scattered papaw (*Asimina triloba*) bushes. Not very far away along Conduit Road I once early in summer observed the giant swallowtail (*Papilio cresphontes*), but its occurrence in this immediate vicinity is only casual.

A somewhat different picture is presented by the higher rolling grassy country in the vicinity of Silver Spring, Md.

Here about the thistles the black swallowtail (*Papilio polyxenes*) is the most abundant of the larger butterflies in the open fields, the yellow (*Papilio glaucus*) and the spicebush (*Papilio troilus*) swallowtails near the woods. The blue swallowtail (*Papilio philenor*) is rather scarce and is far outnumbered by the others. The monarch (*Danaus plexippus*) appears occasionally throughout the region and tends to linger in the damper hollows. The American painted lady (*Pyrameis virginiensis*) is to be met with everywhere on clover or on thistle flowers. Seen mostly on the drier higher areas are the common copper (*Chrysophanus phlaeas*) and the sooty skipper (*Pholisora catullus*), both very few in numbers, and the cabbage butterfly (*Pieris rapae*), which here is fairly numerous. On the drier uplands and along the roads and also in the marshy hollows the buckeye (*Junonia lavinia*) is fairly numerous; those in the damp localities as a rule are larger and somewhat more highly colored than the others and usually streaked with pinkish on the underside of the hind wings. Confined to the marshy areas are the females of the regal fritillary (*Argynnis idalia*) and the Leonard's skipper (*Erynnis leonardus*) and to the vicinity of tree-lined streams the gray darter (*Pyrgus tessellatus*), which is very common. Local and rather scarce, seen mostly along the weedy roads, is the lesser sulphur (*Eurema lisa*).

The other butterflies occur in about the same relative proportions as at Cabin John, but there is a greater variety of the smaller skippers.

In 1926 and 1927 the painted lady (*Pyrameis cardui*) and the azure hairstreak both were common here, but they were absent in 1928, 1929, and 1930.

A drive along the woodland roads anywhere in this region in the middle of September discloses the spicebush swallowtail (*Papilio troilus*) and the black emperor (*Basilarchia arthemis astyanax*) in almost equal numbers, both being seen as scattered individuals, neither abundantly. The hop merchant (*Polygonia comma*), the question mark (*Polygonia interrogationis*), and the Camberwell beauty (*Vanessa antiopa*) from time to time are noticed, and in widely separated places the hackberry butterfly (*Chlorippe celtis*) is common. In the drier woods the yellow swallowtail is seen, and along the woodland streams a few small skippers and occasionally the curious little alder butterfly (*Feniseca tarquinius*).

Perhaps the most interesting locality in the vicinity of Washington is a small boggy marsh on both sides of the road between the Beltsville, Md., railroad station and the experiment farm of the Bureau of Animal Industry of the United States Department of Agriculture. Early in the summer this little marsh abounds with flowers of the buttonbush (*Cephalanthus occidentalis*) and of the handsome *Spiraea latifolia.* Late in summer the numerous tall white flower spikes of *Sanguisorba canadensis* at once attract attention.

Late in June and early in July there are found here in great abundance the grass nymph (*Satyrodes eurydice*), the hovering skipper (*Poanes massasoit*), and the pontiac (*Atrytone pontiac*), and this is the only known locality for the silver-spotted bog fritillary (*Brenthis myrina*) in this region.

THE SUCCESSION OF BUTTERFLIES

About or shortly after the middle of March the Camberwell beauty (*Vanessa antiopa*) and the hop merchant (*Polygonia comma*) are frequently seen in the open woodlands. Though occasional individuals, particularly of the larger and more hardy Camberwell beauty, are sometimes to be met with on warm days throughout the winter months, they do not resume the serious business of life in earnest until the conspicuous flowers of the bloodroot (*Sanguinaria canadensis*) appear above the carpet of fallen leaves.

A week later—that is, at about the end of the third week in March—these two woodland butterflies are joined by the question mark (*Polygonia interrogationis*), and at the same time the males of the zebra swallowtail (*Papilio marcellus*), the orange tip (*Anthocharis genutia*), the common blue (*Lycaenopsis argiolus*), and the cabbage butterfly (*Pieris rapae*) make their first appearance.

The blues soon become common and in a few days females appear, usually before the first of April. The orange tips and cabbage butterflies also increase rapidly in numbers, and the females of both of these are to be found during the first week in April. The zebra swallowtails, like these other butterflies, soon become numerous, but the actual date of the first appearance of the females, which are always scarce in this region, is uncertain.

During the first week in April the first males of the yellow swallowtail (*Papilio glaucus*), which are always of small size, are on the wing, and at the same time appear the earliest individuals of the dusky skippers (*Thanao*s) and of the tailed blue (*Everes comyntas*).

At the end of the first week in April, when the redbud (*Cercis canadensis*), the springbeauty (*Claytonia virginica*), the delicate white (*Viola striata*) and coarse purple (*V. hirsuta*) violets, the star chickweed (*Stellaria pubera*), and the saxifrage (*Saxifraga virginica*) are at their very best, a walk through the still leafless woods will reveal a quite unexpected wealth of butterflies.

Hop merchants, question marks, and Camberwell beauties are surprisingly common, especially the first. At this season they are very easily seen as they wander through the woods. They usually fly 4 or 5 feet above the ground, but on occasion will rise high among the topmost branches of the trees. At this time they are scattered more or less uniformly through the naked woods, instead of being most frequent on the borders of woods, along roads, and about clearings as in the summer; and, furthermore, they are confined to the woods, not straying out over the open country as they do in autumn.

Together with these in the woods are seen numerous white swallowtails, a few orange tips of both sexes, and a few dusky skippers. On the borders of the woods and in bushy areas the common blue is very frequent, and already the individuals of both sexes are largely frayed and worn. Widely scattered males of the yellow swallowtail are noticed, and a few individuals of both sexes of the tailed blue are to be found. The cabbage butterfly now is common everywhere in open areas.

The earliest individuals of the dusky skippers take little interest in flowers. They are to be found sunning themselves on woodland roads, flitting about mud banks, or flying among the leafless branches of the trees from 10 to 20 feet or more above the ground.

During the second week in April the tailed blues and the dusky skippers increase in numbers and become common, and by the end of the second week a few pearl crescents (*Phyciodes tharos*) and occasional males of the yellow clover butterfly (*Colias philodice*) have appeared. The yellow swallowtails are still represented only by small males.

During the third week in April males of the yellow clover butterfly become more frequent, and both yellow and white females are occasionally seen. Most interesting of the butterflies appearing at this time is the grizzled darter (*Pyrgus centaureae*). In the District it is known to fly only in the last half of April, when the temperature is approximately the same as it is in midsummer in the far northern regions where elsewhere this little butterfly has its home.

THE END OF THE SEASON

The end of the season in the fields at Cabin John may well be illustrated by two visits made on October 6 and 7, 1928. Though most of them had faded, flowers of the thistle (*Circium muticum*) still were numerous. Much of the goldenrod (here predominantly *Solidago canadensis* and *S. nemoralis*) had passed, and some had gone to seed. The principal flowers were small white asters (*Aster ericoides*) in very great profusion, smaller patches of a larger light purple kind and, near the woods, small groups of the tall and showy New England aster (*Aster novaeangliae*). Goldenrod in full flower still was very common, and along roadsides and where the grass was thin there were numerous scattered plants of the lovely mistflower (*Eupatorium coelestinum*) ; two of these, growing close together, had flowers of pure white.

These flowers, especially the small white asters and the far less frequent mistflowers, were the ones chiefly visited by the butterflies.

The pink gerardias (*Agalinis purpurea*) still were conspicuous, and in the damper spots were individual plants, small groups, or rarely larger patches of the closed gentian (*Gentiana andrewsi*). Other conspicuous plants were very numerous yellow daisies (*Rudbeckia*) and occasional white daisies (*Chrysanthemum leucanthemum*).

Some of the yellow daisies, the black-eyed-susans (*Rudbeckia hirta*), all fresh and in full flower, growing in the drier areas, bore from five to eight heads, which were always of great size, with the rays from 37 mm. to 43 mm. in length. But most of them, the orange coneflowers (*R. fulgida*), were of quite a different aspect, much branched, and with very numerous and much smaller flowers, with the rays usually about 20 mm. long, and often only from 7 mm. to 10 mm. long or even less. On very many of these plants the rays of all the flowers were in the form of cylindrical tubes with five teeth at the end; on others the rays on every head would be of very diverse forms, strap-shaped, with the edges curved inward and united for a greater or lesser distance from the base, or wholly tubular. A dead example of the small-flowered type of yellow daisy (*R. fulgida*) was pulled up by the roots and the flowers counted. The plant was about a meter tall, and was found to have exactly 350 flowers.

The wonderful wealth of flowers and the vivid colors of the leaves of the bushes and the trees in the field itself and in the woods—the crimson of the sumacs, the light yellows of the tuliptrees, and the yellows, oranges, and browns of other sorts—were an appropriate setting for the butterflies.

There were the usual late-summer insect songs, the incessant droning of the grasshoppers, and the occasional chirp of crickets, while from the wet spots there came from time to time the curious rattling trill of the swamp cricket frog (*Pseudacris feriarum*), the tadpoles of which, in all stages from the newly hatched to fully grown, were to be seen in all the shallow puddles.

Of the butterflies, swallowtails were very few. A number of blue swallowtails (*Papilio philenor*) still coursed about in their impetuous way, but seldom more than one was seen at any time, and often there was none in sight at all. All of them were worn and battered. Several spicebush swallowtails (*Papilio troilus*) were seen, and some of both sexes captured; they were even more battered than the others. A solitary female of the yellow swallowtail (*Papilio glaucus*) of the ochreous form was found on a thistle flower near the woods, and on another thistle in the open fields there was a female of the parsnip swallowtail (*Papilio polyxenes*). Both of these were badly battered.

These were the only butterflies seen to visit thistles except for a single milkweed butterfly (*Danaus plexippus*) fresh from the chrysalis and a solitary battered silver-spotted skipper (*Epargyreus tityrus*).

Of the other larger butterflies there was a worn black admiral (*Basilarchia arthemis astyanax*) flying about an extensive muddy spot, and we also saw some battered viceroys (*Basilarchia archippus*), several males patrolling the roads just as in their palmy days, but now showing much less vigor and scarcely belligerent at all, and a female about some willow bushes.

Commonest of all the butterflies was the lesser sulphur (*Eurema lisa*). In greater or lesser numbers this was everywhere. It was especially numerous, however, in the drier areas where in the thin grass and along the roads the food plant (*Chamaecrista chamaecrista*) was present in abundance. Of this little butterfly most of the individuals were fresh; nearly all of them were males. Every muddy spot had little companies of males, always huddled close together. Usually there were four or five, or half a dozen, but in one company there were more than 20.

Next commonest was the yellow clover (*Colias philodice*), numerous everywhere but especially abundant about the flowers of the small white asters. Most of the individuals were badly rubbed and worn, but some were fresh, especially among the females, and one was found which had only just emerged from the chrysalis, having the wings still soft and damp.

With these were many of the orange clovers (*Colias eurytheme*), which were about one-fifth as numerous as the individuals of the yellow species. Nearly all these were fresh, though a few were worn. A female was found which had only just emerged. Most of the males were of the *amphidusa* form, but most of the females of the *keewaydin*. A few individuals of the small *ariadne* form were seen and captured. In life these were scarcely distinguishable from the yellow clovers.

Most interesting was a beautiful white female of the *keewaydin* form with the fore wings behind the cell faintly tinged with salmon-pink fading to white near the black border, and the hind wings light yellow-olive. Almost as interesting was a female of the *amphidusa* form with the spots in the border of the fore wings orange.

It was evident that the habits of these two butterflies, the yellow and the orange clovers, were less alike than they had been earlier in the season. Possibly it was the absence of flowers from broad grassy areas that emphasized a difference always existing, but usually not conspicuous, or possibly it was due to the freshness and therefore abundant energy of the orange, which contrasted with the battered condition and lesser energy of the yellow, individuals.

There was now a partial segregation of the species. The yellow clovers busied themselves about the flowers and were relatively scarce in the grassy regions bare of asters. The orange were much more active, paying little attention to the flowers or visiting them in a hurried nervous way, stopping at each only for a very little while. About the extensive aster patches the yellow outnumbered the orange more than ten to one, while in the grassy areas the orange butterflies were about as numerous as the yellow, coursing back and forth with a stronger higher flight just as they do earlier in the season.

Everywhere in the grass, but especially along the roadsides, fluttered the pearl crescents (*Phyciodes tharos*), much less numerous than formerly, all rubbed and battered, as alert as ever in spite of broken wings, but not aggressive. Fewer in numbers and equally dilapidated were the tailed blues (*Everes comyntas*). They and the pearl crescents still were to be seen flitting about the puddles or sitting on muddy spots, now as widely separated individuals.

In the grass the sachem (*Atalopedes campestris*) was not uncommon; all caught were battered males. Equally numerous, but less conspicuous, were much worn least skippers (*Ancyloxypha numitor*).

At long intervals just above the grass tops there skimmed a buckeye (*Junonia lavinia*), curiously inconspicuous against the varied background, or a gray darter (*Pyrgus tessellatus*) skipped about in a most erratic way.

Three female cybeles (*Argynnis cybele*) were seen, searching for violets near the woods. All were much broken, but one was fairly fresh. There were no regal fritillaries, though I have previously seen them in this field even later in the season.

On some asters growing in a damp spot with an abundance of the false nettle (*Boehmeria cylindrica*) was a fine red admiral (*Pyrameis atalanta*) of the large blackish form.

Along the borders of the woods and hedgerows and about an extensive partly shaded muddy patch the hop merchant (*Polygonia *comma*) from time to time was seen. All the individuals were fresh, and all were of the light form (*harrisii*).

Seated on a muddy spot in a road in the center of the field was a Camberwell beauty (*Vanessa antiopa*); another was caught on some asters not far off, and a third was seen in the woods among the trees more than 20 feet above the ground.

A single female cabbage butterfly (*Pieris rapae*) fresh from the chrysalis was taken by the roadside.

A week later, on October 13, the autumn was somewhat more advanced. The weather was still warm, the maximum temperature being 85°. The flowers were mostly as before. Thistle flowers and the flowers of *Eupatorium coelestinum* still were numerous, but there was a marked decrease in the goldenrod and in the small white asters. In the woods the leaves were falling, and every little breeze would detach a shower of them.

The songs of the grasshoppers and crickets were less strong. In the marshy spots the rattling trill of the swamp cricket frog still was to be heard. Along the brooks flowing through the woods were many tree frogs sitting on the bank or on the fallen leaves floating in the water.

Swallowtails were rather scarce. In the course of about four hours about a dozen blue swallowtails (*Papilio philenor*) were observed. A single much-battered black female of the yellow swallowtail (*Papilio glaucus*) was caught, and a fairly fresh though much-rubbed female of the parsnip swallowtail (*Papilio polyxenes*). Four milkweed butterflies (*Danaus plexippus*) were seen, all fresh from the chrysalis. Three females of the cybele (*Argynnis cybele*), all extremely worn, were caught. These were the only butterflies that we saw on the thistle flowers.

The lesser sulphur (*Eurema lisa*), though still common, was much less abundant than it was a week ago. Nearly all the individuals had very recently emerged.

Though still abundant, the yellow clovers (*Colias philodice*) had decreased in numbers very noticeably. Most of those caught were fresh. Possibly the old, worn individuals can not long withstand the cold of the present autumn nights. The orange clovers (*Colias eurytheme*) had likewise decreased in numbers. Practically all we caught had recently emerged.

Pearl crescents (*Phyciodes tharos*) still were common, and a few fresh individuals were taken—one or two males and several females. There were a few tailed blues (*Everes comyntas*) about, all very worn.

Skippers were very few. Most noticeable was the gray darter (*Pyrgus tessellatus*), a few of which were seen flying swiftly and erratically just above the grass tops. Most numerous were the much less conspicuous sachems (*Atalopedes campestris*), which from time to time were seen on low-growing flowers. All the individuals of both of these were much frayed and worn. Most surprising was a female of *Thanaos juvenalis*, quite fresh, though with one wing badly torn. A darker individual, presumably a male of the same species, was seen to swerve toward it as it sat on a low-growing aster, and dart away again. The only other skipper seen or taken was a very worn male of *Hylephila phylaeus.*

Along the road were a few buckeyes (*Junonia lavinia*), but the viceroys (*Basilarchia archippus*) had disappeared. We caught, however, a single badly broken male of the variegated fritillary (*Euptoieta claudia*).

Butterflies were very few about the muddy spots. Stray lesser sulphurs and pearl crescents still hovered over them, and at one of them we caught a hop merchant (*Polygonia comma*).

A visit to the meadows on October 21 after a few cool days showed the last appearance of the summer butterflies. Few flowers now were left. The small white asters still bore numerous heads, but these were widely separated on the branchlets and so were not conspicuous. The goldenrod was almost entirely gone. There were few yellow daisies (*Rudbeckia hirta* and *R. fulgida*) and still fewer white ones (*Chrysanthemum leucanthemum*). The *Eupatorium coelestinum* was about as abundant as before. Partridge-peas (*Chamaecrista chamaecrista*) in flower still were common, and we found some widely scattered dandelions and a few plants of the pink gentian (*Sabatia angulata*) with very numerous flowers. In the last half of July this last had been the most abundant and conspicuous of the flowering plants found in these meadows, and large areas were tinged a beautiful pink by it.

In the woods the migrant birds were in very great abundance. Most noticeable were large flocks of thrushes, some wood thrushes, but chiefly thrushes of other kinds. Along the bushy margins of the fields were great numbers of fox sparrows, juncos, and white-throated sparrows. Some of the last at intervals gave forth a rather weak and somewhat imperfect song. In the open groves nuthatches were very common.

Tree frogs were extremely numerous about the streams, and the marsh cricket frogs about the larger puddles in the field. None of the last were singing.

There had been a great decrease in the numbers of the butterflies. The lesser sulphur (*Eurema lisa*) still was common; most of those seen were fresh, and all of them were males. There were numerous yellow clover butterflies (*Colias philodice*), of which nearly all were badly worn, though a few were fresh. The orange clover (*Colias eurytheme*), apparently hardier than the yellow one, was relatively more numerous than before. The fresh individuals we caught were all of the forms *keewaydin* and *ariadne*. Most of the specimens were worn and very faded.

The pearl crescents (*Phyciodes tharos*) seemed to have suffered little diminution in their numbers, and were still quite common. Most of them were badly battered, but a few were fresh.

Only a single swallowtail was seen, a much worn blue swallowtail (*Papilio philenor*). The only skippers found were a few gray darters (*Pyrgus tessellatus*), of which the only one caught was fresh, and a single worn female of the least skipper (*Ancyloxypha numitor*), which was captured on a flower of *Eupatorium coelestinum*.

Most noticeable of the butterflies along the roads were now the overwintering woodland butterflies, the hop merchant (*Polygonia comma*), the question mark (*Polygonia interrogationis*), and the Camberwell beauty (*Vanessa antiopa*). Except for the first these were not numerous, but their presence in the open country and absence from the woods drew attention to them.

REMARKS AND NOTES

To anyone familiar with the regularity of the appearance of the successive broods of butterflies in the north, the determination of the duration and time of appearance of the broods in the District offers a problem of no little difficulty.

The period of emergence of the individuals of the spring brood of many species is very long, and it is often impossible to say whether certain fresh individuals are late examples of the first brood or early examples of the second. This is especially true in the case of the yellow, parsnip, spicebush, and zebra swallowtails (*Papilio glaucus*, *P. polyxenes*, *P. troilus*, and *P. marcellus*, respectively) which are on the wing continuously from their first appearance early in spring, their numbers reaching a maximum in the last half of July, and in the case of the red admiral (*Pyrameis atalanta*) and the American painted lady (*P. virginiensis*), in which butterflies from overwintering chrysalids seem to emerge up to the time of appearance of the butterflies of the summer brood.

Some butterflies with only a single brood have a much longer season here than they do farther north. This is particularly true in the case of two of the local satyrids (*Neonympha eurytus* and *Satyrodes eurydice*). These remain common for a considerably longer time than they do in New England, and persist until the end of summer. I have suspected that late-summer individuals may be the young of spring individuals of the same year—in other words, that they may represent a partial second brood—but there is no proof of this.

As would be expected, most of the local butterflies make their first appearance in spring earlier than they do in Massachusetts. This is particularly true of all the species that hibernate as adults or as pupae, and of the larger species generally. But among the smaller butterflies that hibernate as caterpillars there are some curious exceptions.

The most extraordinary of these exceptions is the silvered bog fritillary (*Brenthis myrina*), which first appears in the vicinity of the District a full month later than it does at Boston—and even at Ottawa, much farther north—and nearly six weeks later than it does at Albany. Furthermore, in this region it has only a single brood, flying in midsummer, instead of three broods as about Boston.

Though the hovering skipper (*Poanes massasoit*) does not appear here until about the first of July, in New England it is on the wing in the first half of June. Similarly, Leonard's skipper (*Erynnis leonardus*) also appears in Massachusetts more than two weeks in advance of its earliest appearance in the District.

The goggle eye (*Cercyonis alope*) is first seen, as casual individuals, somewhat earlier here than about Boston, but the main emergence takes place here about a week later than at Boston.

The grass nymph (*Satyrodes eurydice*) first appears in the District a month earlier than in the vicinity of Boston, but its period of maximum abundance is approximately the same in both places—possibly slightly later here.

The wood nymph (*Neonympha eurytus*) appears at precisely the same time here and at Boston.

The late appearance of many District butterflies and the long season of others, as of the satyrids, possibly are correlated with the curious and unusual irregularities in the temperature in spring, particularly the occurrence of hot spells during which the caterpillars—or a greater or lesser proportion of them—become lethargic and do not feed. This conclusion is suggested by the curious fact that the two widely distributed satyrids (*Neonympha eurytus* and *Cercyonis alope*) always make their first appearance in low wet woods near cold streams and are not seen until later in the warmer and drier areas.

Another fact pointing to the same conclusion is that several District butterflies appear earlier if the spring is cold than they do if the spring is warm or marked by severe hot spells. This was strikingly evident in the spring of 1930, as is shown by the observations given in detail beyond.

The habits of quite a number of the butterflies in the District differ more or less from the habits of the same species farther north. Thus in this area the two sexes of *Poanes hobomok* and of *P. zabulon* inhabit quite different regions. The males are found in damp glades in the woods, and especially along the banks of woodland streams, while the females range widely over open fields. Both sexes are found together only along the borders of damp woods. Such a selective distribution of the sexes is frequent among butterflies in tropical America. In New England, according to my experience, the two sexes of both of these butterflies inhabit the same territory.

Mr. Scudder noticed that in New England among the species of the genus *Thanaos* the females are always less abundant than the males and seldom or never leave their natural haunts, which are overgrown recent clearings, or the thickets and woods themselves, while the males are more fond of the neighboring roads, playing about damp spots, and resting with spread wings with a tameness quite foreign to their nature in the thickets.

In this region the males always outnumber the females and are much more generally distributed. But further generalizations based upon conditions in New England hold good only for *T. brizo*. *T. icelus* here is very common in damp, open fields, often at a considerable distance from any woods, while *T. juvenalis* is also common in open country. In both of these species females, as well as males, are found in the fields. The other species also occur in open country as well as in the woods. In those species having a second brood, the individuals of the second brood have only been found in fields, but this may be due to the fact that during summer and autumn the woods have not been thoroughly searched for them.

It may be mentioned that early in spring, before the appearance of the leaves, *T. juvenalis*, which here as well as farther north is the first to emerge, is frequently seen flying about the higher branches of trees 20 feet or more above the ground. It is not known to do this in the north.

Though in the north *Brenthis myrina* and *B. bellona* are commonly found together, in this region they part company. Only *B. myrina* is found in the vicinity of Washington, while in other places, as about Lewiston, W. Va., I have found only *B. bellona*.

In New England the caterpillars of the yellow swallowtail (*Papilio glaucus*) and of the mourning cloak (*Vanessa antiopa*) are very commonly found on shrubs, bushes, and small trees—wild cherries, willows, and poplars—within from 3 to 6 feet of the ground. In the District area the caterpillars of both of these butterflies are very seldom found, as they seem always to live high in the trees.

The food plants of *Brenthis myrina* and of *Argynnis idalia* in this region should be determined. In the locality where the former is found there are no violets, while the latter freely deposits its eggs on a considerable variety of plants in open fields where violets do not occur.

The relative abundance of many species varies greatly from year to year, while the numbers of others are relatively constant. Thus in 1925 *Junonia lavinia* was abundant, and the handsome " wet " form was very common in the restricted localities where it is found. In the three following years it was much less common, and the " wet " form did not occur. But in 1929 it was very abundant, and the " wet " form reappeared, though in small numbers.

Pyrameis cardui was very common in 1926, frequent in 1927, but absent in 1928, 1929, and 1930. *P. atalanta* was common in 1926, when the " wet " form occurred, and was also common in 1929, when the " wet " form was again found.

Danaus plexippus suddenly appeared in great abundance following a heavy rain in the middle of September, 1930. Before the rain it had been unusually scarce.

Pieris protodice was rather frequent in 1926, but was not seen again until late in the summer of 1930.

Strymon m-album was found in 1926, was rather common in 1927, but was not found in 1928, 1929, or 1930.

Basilarchia arthemis astyanax was unusually common in 1928, but it was very scarce in 1929, and still scarcer in 1930.

The year 1929 was a rather curious one. In the spring hibernated individuals of *Junonia lavinia*, usually rare, were very common, and the butterfly rapidly increased in numbers, becoming extraordinarily abundant. *Thanaos icelus* was unusually common. The little copper (*Chrysophanus phlaeas*) was so common that no less than 30 were taken in a single afternoon in a field at Beltsville, Md., and it was noticed in various places where it had never been seen before. *Phyciodes tharos*, always common, was exceedingly abundant. *Colias eurytheme* for the first time was taken in the District in the spring, and later became more common than *C. philodice.* A curious feature connected with this butterfly was that in this year the light forms greatly predominated over the deeply colored form, most of the individuals seen upon the wing appearing singularly pale. Late in the summer *Phoebis eubule* became unusually numerous, and for the first time a female was found within our limits.

The spring of 1930 was unusually cool and dry. *Poanes zabulon*, *Argynnis cybele*, and *Euphydryas phaëton* appeared at least a week earlier than the normal date. Strange to say, *Argynnis idalia* was not affected, appearing first on June 15 as usual, while *Neonympha eurytus* was first seen, as in former years, on May 30. *Argynnis cybele*, *Poanes zabulon*, *Polites coras*, and *Neonympha eurytus* were unusually common, but all the other local butterflies were scarce, especially the skippers. Even the silver-spotted skipper (*Epargyreus tityrus*) and the sooty skippers (*Thorybes pylades* and *T. daunus*), which as a rule are abundant, were not so very common. No individuals of the spring brood of either species of *Basilarchia* were seen.

The summer of 1930 was hot and very dry. At the end of the season the scarcity of butterflies was very noticeable. Such common species as *Colias philodice*, *Eurema lisa*, *Everes comyntas*, *Phyciodes tharos*, and *Ancyloxypha numitor* were represented by scattered individuals only, and nearly all the other species were correspondingly scarce. *Colias eurytheme* seemed to have suffered less than the other common butterflies, and was far more numerous than *C. philodice.* It was noticed that all the individuals captured, and so far as could be judged all that were seen, were of the *keewaydin* or intermediate form. No examples of either the very light *ariadne* or the deeply colored *eurytheme* form were found.

Of the skippers the most numerous in all suitable localities was *Erynnis leonardus*, which usually is very much less common than *Atalopedes campestris*, *Polites coras*, *P. cernes*, *Ancyloxypha numitor*, and *Epargyreus tityrus*—this last late in the summer of 1930 was exceptionally scarce and was represented only by very few much-worn individuals.

Of the swallowtails the commonest was *Papilio glaucus*, though *P. troilus* was almost as common; *P. philenor*, which is usually by far the commonest swallowtail at this season, was scarce and all the individuals were small or very small; *P. polyxenes* was very rare, and *P. marcellus* was not found at all.

The numbers of the fritillaries (*Argynnis idalia*, *A. cybele*, and *Euptoieta claudia*) seemed to be normal for the season.

The relative abundance of *Papilio glaucus*, the actual numbers of which seemed to be no greater than usual, is probably explained by the fact that this species is here chiefly, or perhaps even entirely, a tree feeder, and trees are less affected by drought than are the shrubs, vines, and herbaceous plants upon which the other swallowtails feed as caterpillars.

Erynnis leonardus is a species confined to more or less permanently wet areas and is therefore the least likely of the late-summer skippers to be affected by drought.

The relative abundance of *Colias eurytheme* probably was mainly the result of the increase to be expected in a recently acclimated species especially well adapted to dry conditions.

The spring of 1931, up to June 1, was mainly devoted to a study of the woods and fields in the vicinity of the lowest of the bogs along Paint Branch.

On April 29 *Incisalia augustinus* and *I. niphon* were found to be rather common here; *Anthocharis genutia* and *Lycaenopsis argiolus* were more numerous than I have seen them elsewhere in this region;

Thanaos juvenalis was abundant, and the small spring form of *Papilio glaucus* was common. The spring form of *Pieris protodice* was seen for the first time, and *Pieris rapae* was noticed.

On May 3 *Thanaos juvenalis* was abundant, *T. horatius* was frequent, and *T. brizo* was fairly common; *Incisalia augustinus* and *I. niphon* were rather common, and *I. henrici* was taken for the first time. *Anthocharis genutia* was common, five individuals of *Pieris protodice* were seen, and a single *Strymon melinus* was caught.

On May 9 *Pholisora catullus*, *Everes comyntas*, *Chrysophanus phlaeas hypophlaeas*, *Phycoides tharos*, and *Thanaos icelus* were found, and the first was common. *Pyrameis atalanta* and *P. virginiensis* were seen for the first time this year, and the first was rather common. *Incisalia augustinus*, *I. niphon*, and *I. henrici* were taken, as well as *Thanaos juvenalis*, *T. horatius*, *Pieris protodice*, and *P. rapae*. *Anthocharis genutia* had disappeared. On the same day a visit was made to Great Falls, where about a small lilac there were observed, all at the same time, males and both yellow and black females of *Papilio glaucus*, both sexes of the dwarf spring form of *Papilio philenor*, a small male of *P. troilus*, a late-spring male of *P. marcellus*, and an example of *Epargyreus tityrus*.

May 17 was cloudy, and few butterflies were seen. Worn individuals of *Pyrameis virginiensis* and both worn and fresh examples of *P. atalanta* were frequent. A single male of *Papilio polyxenes* was observed. Small numbers of *Chrysophanus phlaeas hypophlaeas*, *Phyciodes tharos* (late-spring form), and *Everes comyntas*, and several dilapidated individuals of *Thanaos juvenalis* and of *T. brizo* were taken. Later at Cabin John a single female *Colias philodice* (early-spring form), the first noticed this year, was seen.

May 24 was cool and cloudy, and the only butterflies observed were a number of worn *Pyrameis virginiensis*, one or two *P. atalanta*, and several *Pholisora catullus*, *Everes comyntas*, *Pieris rapae*, *Papilio glaucus* (males), and *P. troilus*.

On May 30 and 31 *Pyrameis atalanta* was not seen, but worn *P. virginiensis* were very common, at least two dozen being met with. They were exceedingly active and very shy. *Pieris protodice* and *Papilio polyxenes* were very common, *Pholisora catullus* was common, and *Pieris rapae*, *Papilio glaucus*, *P. troilus*, and a single very small male *Colias philodice* were seen. No hairstreaks were to be found, and no skippers except for the one mentioned.

It is difficult to compare the records for the spring of 1931 with those for the springs of other years, for the reason that most of the observations were made in a different region where few improvements have been undertaken and where butterflies are therefore more numerous.

The facts that seem significant are that *Pieris protodice*, *Papilio polyxenes*, *Pyrameis atalanta*, and *P. virginiensis* were exceedingly common, the dwarf spring form of *Papilio philenor* and the spring forms of *P. glaucus* were unusually common, and *Colias philodice* and *Pieris rapae* were very scarce, while *Colias eurytheme* was not to be found anywhere.

Later in the season conditions gradually changed, and the relative abundance of the different species became about the same as in other years. After the middle of June the numbers of *Pieris protodice* rapidly diminished, and those of *P. rapae* rapidly increased, so that at the end of the season the latter was abundant and the former scarce. *Colias eurytheme* appeared in small numbers at the end of June when *C. philodice* was common, and at the end of summer had become very abundant, far outnumbering the latter. *Pyrameis cardui* appeared in the middle of June, but did not become common; *P. virginiensis* and *P. atalanta* remained common throughout the summer.

The difficulty of collecting a complete representation of the butterflies in any region is well illustrated by the fact that in the spring and summer of 1931 I secured no less than five species—*Incisalia augustinus*, *I. henrici*, *Thanaos brizo*, *Prenes ocola*, and *Phoebis eubule*—that previously I had not taken.

PRESSURE OF POPULATION

The effect of pressure of population among the butterflies is a subject worthy of intensive study. It is well known that increase beyond a certain point in the numbers of very many, if not of most, types of animals induces more or less profound modifications in what are regarded as the normal habits.

Pressure of population is usually looked upon as resulting either from an increase in the numbers of a given species to a point where the food supply is endangered or from a reduction in the quantity of the available food following a drought or comparable adverse circumstance.

But among most of our local butterflies the effects of pressure of population are first evident long before there can be any question of real danger to the food plants of the larvae. Furthermore, the effects are observable only in the males, whereas the menace to the food plants comes from the unaffected females.

In many species of butterflies the males, if they increase beyond a certain number, seem to be unable to live together peacefully in the presence of females, although they are perfectly well able to live together if they are in areas devoid of females. This is well illustrated by our mud-puddle and roadside butterflies.

Familiar to everyone late in summer is the sight of a shrinking puddle surrounded by a muddy patch enlivened by a greater or lesser number of butterflies usually grouped in little companies, each company as a rule including butterflies of only a single kind, or at least of only a single color.

The characteristic puddle butterflies in the vicinity of the District are the yellow clover (*Colias philodice*), the lisa, or lesser sulphur (*Eurema lisa*), the pearl crescent (*Phyciodes tharos*), the tailed blue (*Everes comyntas*), and the yellow (*Papilio glaucus*) and the zebra (*P. marcellus*) swallowtails. Not far beyond the borders of the District the nicippe (*Eurema nicippe*) and the giant, or cloudless, sulphur (*Phoebis eubule*) are characteristic puddle butterflies.

Various other species are often seen about muddy spots, especially the silver-spotted skipper (*Epargyreus tityrus*) in the last half of June and the first half of July, when it is most abundant, other skippers at the same time and later in the season, the black admiral (*Basilarchia arthemis astyanax*), the spicebush (*Papilio troilus*) and black (*P. polyxenes*) swallowtails, the alder butterfly (*Feniseca tarquinius*), the buckeye (*Junonia lavinia*), the common blue (*Lycaenopsis argiolus pseudargiolus*), the hop merchant (*Polygonia comma*), the Camberwell beauty (*Vanessa antiopa*), the question mark (*Polygonia interrogationis*), the American painted lady (*Pyrameis virginiensis*), the red admiral (*P. atalanta*), and a few others. But these are always present as occasional individuals and can not be classed as true puddle butterflies.

In connection with puddle butterflies it is noticeable that all, or practically all, are fresh males; their wings are sometimes slit or torn, but they are almost never rubbed.

During the last week in August, 1929, special attention was paid to the pearl crescent (*Phyciodes tharos*), which was exceedingly common about puddles and also in the fields. About the puddles all the individuals were fresh males, while in the fields adjacent both males and females were common, but nearly all the individuals, especially the males, were worn and ragged. A week later fresh individuals of both sexes, but especially males, were common throughout the fields.

So far as could be judged from the detailed observations, there seemed to be a continuous procession of freshly emerged males to the puddles and muddy spots and then away again back to the fields, where they gradually became worn and frayed.

Two curious features connected with puddle butterflies are worthy of special notice. In the first place, puddle butterflies late in summer will collect shortly after a rain, when there can be no question of a sufficiency of water in the fields. In the second place, no matter how dry the country may be no puddle butterflies will be seen unless the puddle species are very common. Thus in the exceptionally dry summer of 1930, when the numbers of all the butterflies were greatly reduced, the muddy patches were entirely deserted—not a single example of even the commonest of our puddle butterflies was to be found on them.

The true explanation of the puddle butterflies seems to be that they are males from overpopulated areas in which they are incessantly tormented by other males and from which they escape to more peaceful surroundings. Requiring water, they naturally resort to the puddles about which, in the absence of females, they fail to develop their usual pugnacity and instead become gregarious, flocking with others of their kind or with males of several kinds until they become fully mature, when they either return to the field from which they were originally driven or, remaining more or less gregarious, wander away.

The appearance of the puddle butterflies is always evidence of an excess in the number of individuals of the species concerned in any given area. It is primarily evidence of a growing pressure of population.

Before leaving the subject of puddle butterflies it may be remarked that very worn and battered females are occasionally, though very rarely, observed about puddles. To these the males pay no attention. Similarly worn and battered males are also occasionally seen. These are always solitary and never show any inclination to join the groups of younger males.

Comparable in certain ways to the puddle butterflies are the roadside butterflies. Our typical roadside butterflies are the pearl crescent (*Phyciodes tharos*), the buckeye (*Junonia lavinia*), the viceroy (*Basilarchia archippus*), the hop merchant (*Polygonia comma*), the question mark (*P. interregationis*), the red admiral (*Pyrameis atalanta*), and the Camberwell beauty (*Vanessa antiopa*).

The pearl crescent is almost as much of a puddle butterfly as it is a roadside butterfly, but while very common about puddles it is by no means so gregarious as the more typical yellow or bright-orange puddle butterflies. All the other roadside butterflies are to be seen more or less frequently about puddles and muddy spots, but always as individuals and never in groups.

Roadside butterflies first make their appearance in midsummer and gradually increase in numbers until the end of the season. They never appear among the individuals of spring or early-summer broods. If for any reason the numbers of a species are reduced below the normal, no individuals of that species will be found as roadside butterflies. Thus in the summer of 1930, when all butterflies were relatively scarce, it was noticed that roadside butterflies, which had been abundant the preceding summer, were wholly absent from this region.

As in the case of puddle butterflies, roadside butterflies are all males, and practically all of them are fresh. Worn and battered males and very worn females are occasionally seen, but are quite exceptional. Roadside butterflies are always exceedingly pugnacious —even vicious—and in this they differ from the typical social puddle butterflies. They at once attack any individual of their own kind that ventures near them, and they dash after bees, wasps, grasshoppers, large flies, and such of the larger butterflies as come their way. All of them seem to have a special dislike for the large, slow-flying, and rather clumsy milkweed butterfly (*Danaus plexippus*). For some reason—possibly because of its black wings—the Carolina locust (*Dissosteira carolina*) always invites attack by the roadside butterflies, particularly the buckeye (*Junonia lavinia*). Farther north it is attacked even by such small and weak species as the common copper (*Chrysophanus phlaeas hypophlaeas*). I have seen smaller clear-winged grasshoppers attacked by the very smallest of our local butterflies, the little tailed blue (*Everes comyntas*).

In the case of the pearl crescent and of the buckeye I have noticed that with the coming in of a new brood fresh males first appeared along the roads, later gradually supplanting the worn males in the fields, just as in the case of the puddle butterflies.

Roadside butterflies appear to be fresh males that are unable to cope with the older males in the fields and are therefore driven beyond the limits of the areas wherein the females live. As they mature and as the older males die off they are able to go back to the fields, in their turn helping to drive out such young rivals as may appear.

It should be noticed that some of our roadside butterflies—the buckeye (*Junonia lavinia*), the red admiral (*Pyrameis atalanta*), the hop merchant (*Polygonia comma*), and the question mark (*P. interrogationis*)—occur in two forms, one of which is dark colored and relatively inactive. In these butterflies the males of the dark forms are never seen as roadside butterflies no matter how abundant they may be. These dark forms, like the cabbage butterfly and the orange clover among the pierids, seem not to be affected by pressure of population.

Roadside butterflies and puddle butterflies both represent surplus males exiled by pressure of population long before there can be any question of danger to the food plants. These exiled surplus males are divided into puddle and roadside butterflies simply by their relative ability or inability to get along together. Species in which the males, in the absence of the rivalry incited by the presence of females, are more or less gregarious become puddle butterflies, while species in which the males are always quarrelsome whether females are present or not are unable to take advantage of the puddles and muddy spots and become more or less evenly distributed over barren areas devoid of the food plant and of females, being in this area most conspicuous along the roads.

BUTTERFLIES AND STORMS

In the drier portions of the Tropics, heavy showers following a period of dry weather are succeeded in a few hours by the appearance of great numbers of butterflies of various kinds, and in certain places this phenomenon is very striking.

In summer in the vicinity of Washington the best collecting is always to be found on the day following a severe thunderstorm, and on the day succeeding. On these days the insects are mostly fresh from the pupa, and good series of first-class specimens may be obtained.

One reason for the excellent condition of the butterflies on the days immediately following a violent storm is that the old, worn, and weak individuals are killed off, only the more vigorous surviving. But this does not seem wholly to account for the facts. The storm itself seems to stimulate the emergence of fresh individuals.

The emergence of many of the Lepidoptera can be greatly delayed by keeping the pupae in dry surroundings, restoration of the normal conditions causing them to appear promptly. In the case of the Ailanthus silkworm moth (*Philosamia cynthia*), I have obtained perfect adults from cocoons that had remained dormant, under conditions of abnormal dryness, for more than 20 months.

The effect of a heavy rain is undoubtedly the result of the great increase in the supply of available water, the additional moisture enabling the butterflies immediately to complete their transformation to the adult—or rather to escape from the pupa.

Though the increased proportion of fresh butterflies after a rain in summer is often very evident and obvious, the actual number of individuals on the wing is as a rule not appreciably altered, so that the effect of a storm is not apparent to a casual observer, and indeed is not satisfactorily demonstrable.

The hot and exceptionally dry summer of 1930 furnished an excellent opportunity for making observations on this point.

On September 15 the meadows beyond Cabin John, Md., were thoroughly explored, and the various species present were noted. All butterflies were unusually scarce. The milkweed butterfly (*Danaus plexippus*) especially was infrequent—I saw only four or five.

On the afternoon of the following day (September 16) there was a heavy shower, the first for many days.

On the next day (September 17) the meadows were again visited in order to observe the effect, if any, on the butterflies. It was at once evident that the milkweed butterfly had enormously increased in numbers, and also that those present were without exception quite fresh. Furthermore, by far the greater part of those captured were males. A visit on the following day (September 18) showed this butterfly to be still more numerous, outnumbering all the other kinds of butterflies taken together, while of those captured a slight majority were fresh females.

From the very great increase in the numbers of the male milkweed butterflies on the day following the shower, and of the females on the succeeding day, it would seem evident that the moisture provided by the shower had enabled many of these insects, prevented from emerging by the dryness, to escape from the chrysalids. In the case of this species the sudden increase in the numbers of individuals could not have been due to the normal appearance of a late brood, as the emergence of the late-summer brood normally takes place gradually over a period of several weeks' duration, and the males and females remain throughout that time in the same relative proportion—occurring in practically equal numbers. It was undoubtedly the result of the simultaneous appearance of individuals which normally would have emerged over an extended period and, had there been no rain, would have died in the pupal stage.

I can not find that the sudden appearance of the milkweed butterfly in great numbers after storms has previously been recorded. But the name by which this insect is commonly known in certain country districts—storm fritillary—would suggest that it has been noticed.

Of the other species in the meadows, *Eurema lisa* was the only one that became appreciably more numerous immediately after the storm. For the next few days all the individuals of this species seen or taken were fresh.

During the next 10 days the numbers of all the other autumn butterflies—the butterflies that normally issue from the pupa at this season—more or less gradually increased, so that in the last few days of September these were scarcely less common than usual. Two of them, indeed, the Camberwell beauty (*Vanessa antiopa*) and the red admiral (*Pyrameis atalanta*), seemed to be rather unusually numerous. This may have been due, however, to the fact that they remained strictly in the damp woods, not straying widely over the fields as is their normal habit at this season. On the other hand, *Colias philodice* remained rather infrequent, and its numbers were insignificant in comparison with those of *C. eurytheme*.

After the first of October the number of butterflies, in the absence of any further showers, slowly decreased, and a brief survey of the meadows west of Cabin John on October 15 disclosed only about a dozen *Colias eurytheme*, about the same number of *Phyciodes tharos*, and a single *Pieris protodice*.

EXTIRPATION OF ONE BUTTERFLY BY ANOTHER

During the past four years the orange clover butterfly (*Colias eurytheme*) has enormously increased in numbers in the District area, and within the past two years the numbers of the yellow species (*C. philodice*) have not only relatively but actually decreased.

The orange species is a more active butterfly than the yellow and is stronger and swifter on the wing. When the two species exist together the orange males are frequently observed to annoy both sexes of the weaker yellow species.

If we may judge by the frequent appearance of the males in numbers as puddle butterflies, the yellow species is sensitive to overcrowding. The same is true of the small pale form (*ariadne*) of the orange species, which, although rare in this region, appears with the yellow species as a puddle butterfly. The larger and darker forms of the orange species (*keewaydin* and *eurytheme*) seem to be unaffected by overcrowding and never appear as puddle butterflies.

Wherever the two species occur together the yellow species would be affected by the males of the active and powerful orange species more than it would by its own males, whereas the orange species would not in any way be affected by the yellow. Thus overcrowding in the case of the yellow species would occur in proportion to the numbers of the males of the two species combined and not in proportion to the numbers of the males of the yellow form alone. With the increase in the numbers of the orange species the yellow would gradually decrease in numbers through the driving out from the breeding areas of the yellow males, and through the decrease in the number of successful matings as a result of the constant annoyance of both sexes.

This seems to be what is actually taking place. The strong and active orange species (*Colias eurytheme*) is causing a progressive diminution in the numbers of the weaker and less active yellow species (*C. philodice*). It will be interesting to see whether the yellow species will be able to maintain itself in the face of the continued annoyance by the orange, or whether it will be reduced to insignificant numbers or even perhaps die out.

The yellow species has never been a pest, possibly because of its sensitiveness to overcrowding. The orange species, on the other hand, which seems not to be affected by overcrowding, from time to time becomes a more or less serious pest in certain regions in the West, and in some sections its caterpillars—known locally as "alfalfa worms"—do really serious damage. It is possible that unless something occurs to check its present increase this butterfly eventually may become harmful here.

Years ago the checkered white (*Pieris protodice*) was very common here and was more or less destructive to cultivated cabbages. But now it is only of casual and very uncertain occurrence. It is a weaker insect than the European white (*Pieris rapae*), and is subject to persecution by it. The relations between the checkered and the European white are almost identical with those between the yellow and the orange clover butterflies (*Colias philodice* and *C. eurytheme*). It is quite probable that the almost complete disappearance of the checkered white has been due mainly to constant persecution of both sexes by the males of its more powerful competitor.

The disappearance of the other native whites (*Pieris napi oleracea* and *P. virginiensis*)—weaker and less active butterflies than the European white—from much of the territory formerly inhabited by them in the Eastern United States may have been due to the same cause.

OBSERVATIONS ON BUTTERFLY MIGRATIONS

Certain observations made during the course of the studies on the local butterflies seem to have a direct bearing on some aspects of those interesting phenomena known as migrations.

The problem of the so-called migrations of butterflies is a very complex one, involving a great number of diverse factors, both external and internal. The external factors have to do with the relation between the insects and their environment, while the internal factors have to do with their general structure, their anatomy, and their physiology—most obviously with that complex of reactions which we call their habits. Though the external factors are, generally speaking, the same for all the species of butterflies found in a given region, the internal factors, especially the habits, vary more or less widely, not only in the different groups, but also often in closely related species within small groups and frequently in alternative, seasonal, or other forms of a single species.

The term "migration," as applied to the linear group movements of insects, is a rather unfortunate one, as it implies a more or less close correspondence with the migrations of birds, with which they have little in common except that they are movements measurable in geographical terms.

Bird migrations are typically movements of a very definite nature from the breeding grounds to another region more or less remote and back again, usually by the same route. In the case of birds the round trip is completed several or many times during the life of the individual, and furthermore the movement usually involves all the normal and healthy individuals of a species in a given area.

Butterfly migrations, on the other hand, rarely involve more than a portion, and often a relatively small portion, of the individuals in any region. So far as the individuals are concerned they are in one direction only, and so far as the species is concerned there is seldom any indication of a definite return movement.

There are other differences between the migrations of birds and the so-called migrations of butterflies, but there are also some curious correspondences.

In some butterflies migration is a regularly recurrent annual phenomenon, in others it takes place more or less frequently but at irregular intervals, while in many it is observed only occasionally. In some butterflies it is more or less characteristic of certain forms within a species but never occurs in an alternative form. It is probable that many butterflies not usually so regarded are in reality migratory, traveling always as independent individuals and possibly at night.

Of all butterfly migrations those that have attracted the most attention have been those of our common milkweed butterfly (*Danaus plexippus*). Observations which, by a fortunate circumstance, we were enabled to make on this butterfly, suggest a possible explanation for its interesting and not infrequently spectacular migratory flights.

In the middle of September, 1930, a heavy rain succeeding a long period of dry weather caused the emergence of this butterfly in great numbers in the meadows west of Cabin John, and the behavior of the insects was carefully watched (see p. 122). For about three days they devoted themselves wholly to feeding, spending the night among the flowers in the meadows. During this time they became more and more sociable, showing an increasing tendency to gather into loose flocks. They then became more restless, and some were observed to rise high in the air and drift away before the wind westward toward Great Falls. At this time they developed a preference for perching on branches of trees rather than simply resting on the goldenrods and other herbaceous plants in the fields as they had previously done. A few days later—just a week after their first appearance—they were seen in Washington, and a visit to the meadows showed that all but a very few of them, which were probably younger than those of the large swarm, had disappeared.

From these observations the origin of a migrating swarm of these butterflies is easily understood. A number were seen to depart high in the air in the same direction. Had the feeding area been more extensive and the insects therefore more numerous, we undoubtedly should have witnessed, instead of the departure of a small number of individuals, the origin and exodus of a migrating swarm.

On the other hand, we were unable to detect in the butterflies as we observed them after their emergence at Cabin John the slightest departure from the normal habits of individual butterflies as they occur throughout the summer. As in the case of many other species, the first few days after emergence are spent by the milkweed butterfly in intensive feeding, while the later adult life is spent mostly in wandering and in reproduction. Whenever this butterfly is common it becomes sociable, and throughout the summer individuals are occasionally seen high in the air, and also in trees.

If the multitudes at Cabin John were developing just as the same number of individuals scattered throughout the summer would have developed, then it becomes evident that the so-called migrations of this species are really nothing more than the collective or mass expression of the normal habits of each of the individuals taking part in the migration. A very large number emerging from the pupa at the same time engorge themselves together and reach the traveling and tree-perching phase of their adult life simultaneously. So we find in the air large numbers together instead of isolated individuals. The appearance of this insect in swarms means, I believe, not that they have intentionally gathered for the purpose of traveling, but simply that something has occurred in their place of origin to cause great numbers to emerge simultaneously.

Two migrations have been reported in this vicinity (see pp. 121, 122). In one the butterflies were flying south across Chesapeake Bay in the face of a stiff breeze, and in the other they were going north with the wind. Those that we saw were going west with the wind.

Most of the migrations of this butterfly that have been reported have been southerly, and this is especially true in the central portion of the continent. It is most unlikely that this southerly direction has more than a coincidental relation to geography. It is far more likely that it will be found to be a function of the prevailing wind plus certain geographical features, especially rivers and the seacoast.

In short, the migrations of the milkweed butterfly appear to be simply a mass expression of the normal habits of each separate individual in a migrating swarm, and the relation of these flights to the south commonly noticed seems to rest solely upon the mechanics of autumnal meteorology and to have no other relation to the procession of the seasons.

It is generally assumed that early in spring there is a northerly migration of this butterfly from the territory in which it is able to survive the winter northward over the territory in which the summer brood is found, and that this migration is performed by widely scattered individuals acting independently of one another. So far as I have been able to ascertain there is no real evidence of any northerly migration in spring. Individuals that have come out of hibernation are commonly faded and putty colored. They seem to have lost the energy that was theirs in the autumn, and fly with continuous wing beats within a few inches of the ground or of the grass tops. They are so inconspicuous as to be easily overlooked, and although I have kept a careful watch for them I have never seen more than half a dozen. But all that I have seen were females searching for plants on which to lay their eggs, and their actions were quite the same as those of ovipositing females in summer.

Yet occasionally individuals which have hibernated seem to be possessed of full vigor. In the spring of 1931 two were reported flying high in the air westward up the Potomac in exactly the same manner as in autumn and in the same direction.

Individuals which have hibernated have been found as far north at least as Boston and Amherst, Mass., in the first half of May. Farther south there are many records of hibernating individuals in May.

In this region fresh butterflies first appear early in June, and they appear at approximately the same time in New England.

The truth of the matter seems to be that a few scattered individuals succeed in surviving the winter as far north as southern New England on the eastern seaboard, and generally speaking everywhere over the territory in which this butterfly is common in summer. From the numerous eggs laid by these few individuals the early-summer brood is derived, and from the eggs laid by the early-summer brood come the very numerous individuals of the late-summer brood.

It must be remembered that this butterfly is singularly free from attack by parasites in the early stages, and also that the pupa, like the adult, seems to be possessed of unusual vitality and to be able to remain dormant for a considerable period, promptly giving forth the butterfly when the conditions become suitable.

According to W. H. Edwards the pupal stage, in southern West Virginia, lasts from 5 to 15 days, but in one case he reported it reduced to 2 days. Mr. Scudder said that in New England the pupa usually hangs for about 12 days, ranging from 9 to 15, but that he has known it to be extended to 3 weeks.

Relatively free from attacks by parasites and possessing unusual vitality in the pupal and adult stages, this insect has potentialities for increase which are much in excess of those of most of our other butterflies.

The scarcity of this species in spring over most of the United States is probably simply the natural result of the immense mortality suffered during the winter in northern latitudes. In the case of most butterflies there is an enormous mortality in each generation resulting from the activities of parasites and predators among the eggs and younger stages. In this form the winter seems to be the chief factor in reducing its numbers.

Before leaving the subject of the milkweed butterfly, it may be recalled that the abundance of this insect late in the summer of 1930 was preceded up to the very day of its appearance in great numbers by unusual scarcity. The appearance of the milkweed butterfly in great numbers following a season in which it has been exceptionally uncommon has already been noted. Mr. Scudder wrote that Miss Harrington saw it in abundance at Magnolia, Mass., in the autumn of 1888, and that he had found it abundant at Hampton, N. H., not far away, at the same time, but it had been exceptionally scarce in the spring of that year.

Quite different in their nature from the migrations of the milkweed butterfly are the migrations of the pierids, in which the migrating flocks are composed wholly, or almost wholly, of males.

It has already been suggested (pp. 45–47) that the little groups of male pierids found about puddles late in summer are evidence of overcrowding in the home territory. Puddle butterflies, at least in the pierids, are young males freshly emerged and in need of food, or at least of water. They are unable to feed quietly in the fields because of the constant persecution by the older males, so they escape to areas where the food plant and females are absent, whenever possible gathering on mud from which they can obtain in peace the water that they need.

Many, perhaps most, of the young males are only temporary exiles, returning to the fields when they have sufficiently matured and as the older males die off. But it is quite probable that many of them would be unable to find a place for themselves in the fields and would therefore be permanently exiled. Such males would be very likely to wander—the males wander in any case—and in their wandering they would presumably fly in a more or less straight line against the wind, which is the usual habit of the individuals males of our common species when simply traveling. Late in summer the conspicuous males of *Phoebis eubule* are occasionally noticed in the Smithsonian Institution and Department of Agriculture grounds flying eastward against the wind.

It is a reasonable assumption that surplus males of our two local pierids most given to migratory flights—*Phoebis eubule* and *Eurema lisa*—would normally wander away, flying primarily against the wind. Being gregarious and very readily decoyed—even by crude paper imitations—other surplus males would tend to join them until finally a considerable number would be assembled in a loosely gregarious swarm. The nucleus of such a swarm might come from puddle butterflies, from exiled males in any area, from persecuted males still in the fields, or from all three sources.

Elimination of surplus males may take place when, so far as we can see, there is no actual evidence of overcrowding in the fields, especially in the case of such large, powerful, and very active species as *Phoebis eubule.*

The migrations of the pierids of the types corresponding to our *Phoebis eubule* and *Eurema lisa* seem to be nothing more than the end product of the natural process of the elimination of surplus males.

Much has been written regarding the southern late-summer and autumnal migrations of *Danaus plexippus*, but little has been said of the northerly migrations of *Phoebis eubule* that from time to time take place at the same seasons and in the same regions in the coastal area. As a concrete instance of migrations in opposite directions taking place simultaneously, I may cite the fact that in the very field where I observed *Danaus plexippus* going west with the wind I have seen the males of *Phoebis eubule* flying high and very fast eastward against the wind.

If the migrations of these butterflies were anything more than relatively simple responses to the meteorological and other physical conditions—that is, if they served any purpose beneficial to the individuals taking part in them—we should scarcely expect to find two primarily tropical butterflies migrating in opposite directions in the same place simultaneously, especially north and south.

The solution of the problem of butterfly migrations lies, I believe, in an accurate and detailed knowledge of the normal sequence of habits of both sexes of the species involved—in the case of dimorphic or polymorphic species of both sexes of each of the several forms—from the time of emergence from the pupa until death; of the real or apparent changes in the normal habits induced by overcrowding or by the destruction of the food plant; of the relations of the individuals of a species, particularly the males, to one another and to related species in the same region; and of the relations of the individuals of a species to the meteorological and geographical environment.

SUGGESTIONS FOR STUDYING BUTTERFLIES

Though in the District of Columbia, as elsewhere, a complete collection of the local butterflies can be assembled only by long-continued systematic search in all the various types of habitat frequented by the species which presumably occur, a fairly representative collection may be made in a relatively short time by taking advantage of some of the peculiarities of these insects.

Many—indeed, most—butterflies are very fond of certain flowers and may most easily be captured about their favorite plants. Especially productive are those plants which, bearing attractive flowers, rise high above the grass and are isolated or more or less widely scattered. On such plants butterflies will congregate from over an extensive area.

So far as butterflies are concerned, by far the most attractive of all flowers, wild or cultivated, are the showy orange blossoms of the butterflyweed (*Asclepias tuberosa*), which derives its common name from the marked partiality shown it by these insects.

When the butterflyweed rises above the grass tops, a surprisingly large proportion of the butterflies in its vicinity will congregate upon its orange heads. It is the favorite of all the flower-feeding species from the swallowtails and the milkweed butterfly down to the smallest blues and skippers. Always on these heads the pearl crescent (*Phyciodes tharos*) outnumbers all the other species when it is in season. Not infrequently all the available space on a flower head will be occupied by a butterfly, while in the air above there flutter several butterflies looking for an opportunity to settle.

But if the grass is tall and rises above the flowers, the larger butterflies, such as the swallowtails and the fritillaries, will not visit them, and the numbers of the smaller species are also much reduced.

The common milkweed (*Asclepias syriaca*) and the swamp milkweed (*A. incarnata*) are also favorites of most flower-feeding butterflies, particularly the fritillaries, the milkweed butterfly, the swallowtails, certain of the hairstreaks (*Strymon*), and the larger skippers. But those butterflies, such as the painted ladies (*Pyrameis cardui* and *P. virginiensis*), the red admiral (*Pyrameis atalanta*), and the buckeye (*Junonia lavinia*), that prefer to feed on flowers on the summit of a stalk rising above the surrounding vegetation, on which they rest by preference with the body horizontal, as a rule avoid the milkweeds.

The buttonbush (*Cephalanthus occidentalis*) is favored by very many different kinds of butterflies, but where it grows it usually is so very common that the butterflies feeding on it are rather widely scattered.

Jersey-tea (*Ceanothus americanus*), growing near extensive patches of scrub oak and in the proximity of numerous large ant hills, forms an appropriate setting for the hairstreaks; but in this area all the species so frequent on this plant in more northern regions are local and uncommon.

Early in spring the flowers of blueberries (*Vaccinium*) and of blackberries (*Rubus*) and later of the Japanese honeysuckle (*Lonicera japonica*) are visited by many species, the last especially by the woodland swallowtails, and the other two by skippers. At the beginning of the season the zebra swallowtails (*Papilio marcellus*), in the absence of other flowers, will feed on blueberry blossoms so very near the ground that their tails almost or quite touch the earth.

Late in summer large patches of thistles form by far the best collecting grounds, and if these are in the vicinity of woods they are sure to be visited by numbers of the woodland swallowtails.

In addition to these plants very many others, especially among the clovers and the taller and more scattered composites, are very attractive to most kinds of butterflies.

When engaged in feeding most butterflies are easily approached, no matter how shy they may be under other circumstances. Some flowers produce in them an effect quite similar to intoxication, whereby their capture is facilitated. For instance, the Indianpipe (*Monotropa uniflora*), which is a favorite of the larger wood-frequenting skippers (*Epargyreus* and *Thorybes*), causes them to exhibit curious irregularities of movement and a greater or lesser degree of stupefaction.

Though plants with attractive flowers in general afford the best collecting grounds, particularly for the larger and more conspicuous species, many different kinds of butterflies seldom or never visit flowers, while others are captured most readily elsewhere than on flowers.

In the drier portions of the summer patches of wet mud near woods, or in open fields or country roads, are excellent collecting grounds. All the species having the peculiar habit of gathering in groups or companies on mud, such as the yellow swallowtail (*Papilio glaucus*), the eubule (*Phoebis eubule*), the yellow clover (*Colias philodice*), and the lisa (*Eurema lisa*), are very easily decoyed by imitation butterflies cut from colored paper or by dead butterflies of their own kind.

Most of our woodland butterflies are readily secured by baiting with carrion. Dead snakes suspended about 5 feet above the ground in an open glade or clearing make, perhaps, the most effective bait. The hackberry butterfly (*Chlorippe celtis*) and the tawny emperor (*C. clyton*), which ordinarily remain high in the trees and are exceedingly active and difficult to catch, are easily obtained by the use of carrion, on which they often feed to the point of partial stupefaction.

Other woodland butterflies which are active and difficult to catch are extremely fond of alcoholic liquids. Piles of decaying fruit, particularly grapes, have an irresistible attraction for them, and on these they sometimes feed to a state of advanced intoxication.

Many kinds of butterflies tend to gather and to remain in certain areas of limited extent. Boggy hollows in open country which are more or less protected from the wind, especially when they support an abundance of such plants as the red milkweed (*Asclepias incarnata*), buttonbush (*Cephalanthus occidentalis*), boneset (*Eupatorium perfoliatum*), and joe-pye-weed (*E. purpureum*) always are productive. Butterflies stray into these and are induced to remain by the dampness and the flowers.

Clover fields on exposed hillsides, especially if the crest of the hill be wooded, are particularly favorable. The butterflies of the open country drift up the hill and tend to remain more or less near the woods, which, however, they do not enter. The woodland butterflies stray into the field in order to feed upon the clover or play about the bushes along the borders of the woods. The borders of woodlands are a favorite mating ground for many different kinds of butterflies.

Roadsides, whether in open country or in woods, are always good collecting grounds, though yielding mostly males. Many woodland species, which ordinarily remain high in the trees or which are exceedingly active and difficult to catch, delight in sunning themselves on the leaves of bushes growing along the roads and in the glades and clearings, or even on the ground. Especially is this true early in the morning or after a sudden shower.

In spring the best days for collecting butterflies are warm and sunny days with little wind. In summer the best results are to be obtained on sunny days following evening thunderstorms.

Certain butterflies are to be found most readily by looking for their food plants and then visiting these at the proper season. Hackberry trees (*Celtis occidentalis*) support the hackberry butterfly (*Chlorippe celtis*), the tawny emperor (*Chlorippe clyton*), and the snout or beaked butterfly (*Libythea bachmanii*), and also, together with other mostly related plants, the common angle wings (*Polygonia comma* and *P. interrogationis*) and the Camberwell beauty (*Vanessa antiopa*). Small willows in moist meadows support the viceroy (*Basilarchia archippus*) and sometimes the Camberwell beauty, and both of these are often to be found about small poplars growing on hillsides. An extensive growth of sheep sorrel (*Rumex acetosella*) in a barren field is a certain indication of the occurrence of the little copper (*Chrysophanus phlaeas hypophlaeas*).

The redcedar (*Juniperus virginianus*) supports the olive hairstreak (*Mitoura gryneus*), while the banded elfin (*Incisalia niphon*) is only to be found near pines. The turtlehead or balmony (*Chelone* *glabra*) growing in bogs is an indication of the probable occurrence of the turtlehead butterfly (*Euphydryas phaëton*), while the presence of pigweed (*Chenopodium album*), in farmyards, waste land, vacant lots, gardens, and along roads, is a certain sign of the presence of the sooty skipper (*Pholisora catullus*).

In low open woods with large rough-barked trees, particularly oaks, the presence of small cruciferous plants, especially the mouse-ear cress (*Sisymbrium thalianum*) and the toothworts (*Dentaria laciniata* and *D. heterophylla*), is an almost certain sign of the presence early in spring of the orange tip (*Anthocharis genutia*).

In any region the occurrence of many different kinds of butterflies is more easily determined by searching for the caterpillars than by hunting for the adults. In the District this is particularly true of the sooty skipper (*Pholisora catullus*), which is small, inconspicuous, wary, and elusive, while its caterpillars everywhere abound on pigweed and are easily raised to adults. It is equally true of the turtlehead butterfly (*Euphydryas phaëton*), which is sluggish and inconspicuous and extremely local. Its caterpillars, however, form very conspicuous webs on the summit of the food plant. The alder butterfly (*Feniseca tarquinius*) is most readily obtained by raising its caterpillars, which are to be found in the masses of white woolly aphids on the alders or in the leaf curls of the aphids of the beech. The viceroy (*Basilarchia archippus*) is most easily secured by raising it from its caterpillars, which are to be found on small willows and on small poplars. Up to about the middle of August the milkweed butterfly (*Danaus plexippus*) is readily obtained by raising the conspicuous and easily discoverable caterpillars. Wherever the giant swallowtail (*Papilio cresphontes*) occurs its caterpillars, known as "orange dogs," are easily found on various plants related to the orange (family Rutaceae). In this region they are to be looked for on the hoptree (*Ptelea trifoliata*) and on the prickly-ash (*Zanthoxylum americanum*), though they may occur on other trees, especially on poplars.

Specimens of butterflies that have been raised from caterpillars should always be so labeled, as they are often smaller or larger than individuals caught in the wild, and sometimes differ more or less markedly in color or in wing form from them.

In spite of all that has been said above, it should be constantly remembered that there is no real substitute for work. Though the gathering of the larger, more conspicuous, and more characteristic of the butterflies in any region is always a relatively simple matter, the assembling of a really representative collection necessitates long-continued, monotonous, and often discouraging labor extending over a long period of years.

KEY TO THE SUPERFAMILIES OF BUTTERFLIES

a^1. Head of moderate width or narrow; front less than twice as broad as high; antennae separated at their base by about their width or less; no eyelashes................ Papilionoidea (p. 62).

a^2. Head very broad; front twice as wide as high; antennae separated at their base by from 2 to 4 times their width; a strong but slender tuft of lashes in front of the eyes. Hesperioidea (p. 200).

Superfamily PAPILIONOIDEA: The True Butterflies

KEY TO THE FAMILIES

a^1. Forelegs, or at least the forefeet, imperfect in the male or in both sexes; colors never white, yellow, or orange; hind wings rounded, angled, or with one or two very slender hairlike tails, never with broad and conspicuous tails.

b^1. Forelegs in both sexes greatly reduced and brushlike, held tightly appressed against the body so that the insects appear to have only four legs; bases of the antennae not encroaching on the eyes...................... Nymphalidae (p. 62).

b^2. Forelegs normal in the female; bases of the antennae encroaching on the eyes.

c^1. Eyes surrounded by a conspicuous white ring; forelegs of males nearly perfect, but the foot without normal terminal claws; wings when at rest held together above the back...................................... Lycaenidae (p. 128).

c^2. No white ring about the eyes; forelegs of males greatly reduced and brushlike, held against the body; wings when at rest spread out and flattened against the supporting surface........................... Riodinidae (p. 128).

a^2. Forelegs perfect in both sexes; hind wings with broad tails, or rounded; if the hind wings are rounded, the color above is white, almost plain or more or less spotted with black, clear yellow, or white, bright yellow, or bright orange with a black border................................. Papilionidae (p. 147).

Family NYMPHALIDAE

KEY TO THE SUBFAMILIES

a^1. Palpi not longer than the thorax.

b^1. Some of the veins of the fore wings swollen for a greater or lesser distance from the base; outer border of the fore wings markedly convex, the apex never produced; under surface of the wings with a greater or lesser number of eye spots in the outer portion, which may be repeated on the upper surface; color grayish brown, or brown with a broad yellow band containing two large eye spots on the fore wings...................................... Satyrinae (p. 63).

- b^2. None of the veins of the fore wings swollen at the base.
  - c^1. Antennae abundantly clothed with scales------- **Nymphalinae** (p. 71).
  - c^2. Antennae naked, without scales------------------- **Danainae** (p. 115).
- a^2. Palpi greatly elongated, longer than the thorax, forming a conspicuous beaklike process---------------------- **Libytheinae** (p. 128).

Subfamily SATYRINAE

KEY TO THE SPECIES

- a^1. No broad yellow band inclosing two large eye spots crossing the outer half of the fore wing.
  - b^1. Smaller, the fore wing about 20 mm. long; fore and hind wings each with two conspicuous circular black spots narrowly ringed with yellow and showing two small patches of silver scales near the center situated near the angles of the wings on both surfaces (pl. 1, figs. 1, 2; pl. 2, fig. 1). **Neonympha eurytus** (p. 63).
  - b^2. Larger, the fore wing about 27 mm. long; fore wing below with a row of four black spots narrowly ringed with light yellow-brown, dark yellow-brown, and whitish near the outer margin; hind wing below with five similar spots, the first separated from the others, and a small double spot near the anal angle; these spots are repeated, less well defined, and usually without the white centers, on the upper surface (pl. 1, figs. 3–6)-------- **Satyrodes eurydice** (p. 65).
- a^2. Outer half of fore wing crossed by a broad yellow band including two conspicuous black eye spots with blue and white centers (pl. 3, figs. 1–4)--------------- **Cercyonis alope** (p. 68).

Genus NEONYMPHA Westwood

NEONYMPHA EURYTUS (Fabricius)

WOOD NYMPH

Plate 1, Figures 1, 2; Plate 2, Figure 1

Occurrence.—More or less frequent, sometimes rather common, in open deciduous woods, especially where there is an undergrowth of bracken (*Pteris aquilina*). It is most numerous in the woods along the Potomac River from Cabin John to Great Falls and along the Eastern Branch, occurring more sparingly in the woods along Rock Creek, Paint Branch, and the other smaller streams. From time to time it appears locally in considerable abundance.

Like its local relatives, the wood nymph is found only in a certain type of surroundings—in this case damp, though not wet, deciduous woods—and is more or less numerous, sometimes even common, wherever the proper conditions obtain.

Habits.—This butterfly has a jerky, dancing flight, skipping about 2 or 3 feet above the ground through the more open portions of the woods, and especially in the glades and along the woodland roads.

It is alert and quick and rather shy, and when alarmed dashes wildly off into the nearest thicket or drops into the grass. It is sometimes found in the borders of fields adjacent to woods, and here it is much more easily caught than in the woods themselves. Though it is most active on hot and sunny days, it also flies more or less in cloudy weather, or even in a light rain, and under these conditions it is less wary than when the sun is shining.

It is fond of sunning itself on a leaf or log or stone with the wings closed above the back, the body at right angles to the path of the sun's rays, and the wings so tilted that the sunlight falls perpendicularly upon them. But sometimes, especially in the early morning and after a rain, it will rest with its back to the sun and with the wings more or less widely spread.

In taking up a position on a sunlit leaf the butterfly drops suddenly down with the wings closed, abruptly turns itself at right angles to the sun's rays, and with a jerk tilts its wings to the proper plane. As Mr. Scudder has noticed, it has a curious jerky walk somewhat like that of a wasp.

Season.—The wood nymph first appears at the very end of May and is common throughout June and most of July, fresh individuals appearing quite throughout the month in diminishing numbers. Early in August the numbers rapidly decrease, and by the end of the first week in August it has almost completely disappeared. Occasional individuals, however, are sometimes met with throughout August and even until the end of September.

As a rule the increase in the numbers of this species after its first appearance is gradual, and the numbers diminish gradually in the last half of July and with increasing rapidity in early August. The individuals on the wing at any one time are therefore never very numerous. Sometimes, however, as in 1930 (May 30), it appears suddenly in large numbers and almost or quite disappears early in July.

The usual delayed emergence of this species is probably due to the effect of hot spells in spring, the influence of which is very variable according to local factors, such as proximity to cold streams and bogs. In cool seasons the butterflies tend to emerge more nearly simultaneously, giving the appearance of unusual abundance, later disappearing simultaneously.

Mr. Scudder says that this butterfly appears in the extreme south of New England about May 20, and in the vicinity of Boston usually at the close of the month or the very first of June. It remains common throughout June, seldom much longer, but occasional specimens may be taken far into July.

F. H. Sprague said that in eastern Massachusetts very few good specimens are met with after the middle of June, and by the first of

July they have altogether disappeared with the exception of perhaps a dilapidated one here and there. This accords with Mr. Scudder's observations, and also with mine. But in central Massachusetts, in the hilly region of the Connecticut Valley, Mr. Sprague took fresh males sparingly from July 6 to 10. These were not accompanied by a single female, nor by any worn individuals. For the next three days he took several more good and fair specimens of both sexes, but none poor. This was in 1885. In other years faded specimens were taken in the same region until after August 1.

W. H. Edwards reported fresh individuals in southern West Virginia in autumn, and it is reported from Bushnell in the mountains of North Carolina on September 1. Mr. Edwards reared one to imago from eggs of the same year. Mr. Scudder did the same in Cambridge, though in the house, and the caterpillar did not pupate until October 13.

In the District this butterfly first appears at precisely the same time that it does in the vicinity of Boston. But instead of disappearing by the middle of July it usually flies into August, and fresh individuals are of casual occurrence throughout August and September. Apparently the same thing occurs in the Kanawha Valley in West Virginia, and in the mountains, though not in the lower portions, of North Carolina.

Very late individuals, which so far as my experience goes are only to be found at Beltsville, Md., and in the vicinity of the Eastern Branch and seem never to occur in the Potomac Valley west of Washington, are probably from eggs laid earlier in the same year.

Notes.—Specimens from the District are slightly darker and somewhat more grayish than specimens taken in the vicinity of Boston. They also reach a slightly larger size, the largest local females having the fore wing 23 mm. long.

Genus SATYRODES Scudder

SATYRODES EURYDICE (Johanssen)

GRASS NYMPH

Plate 1, Figures 3 to 6

Occurrence.—Very local, but common where it is found. Ernest Shoemaker writes that on several occasions he has found this species quite common along the Eastern Branch. It is very common in the bogs at Beltsville, Md., and I have seen a single individual flying across a field immediately east of Paint Branch just north of the road to Ules Crossing. Mr. Shoemaker has also taken it at Carlin Springs, Fairfax County, Va., in swampy spots along the brook a very short distance from the spring.

This butterfly is confined to wet meadows bordered or surrounded by woods and closely adjacent to, or traversed by, a running stream, especially on hillsides or at the base of rising ground. It also occurs, sometimes plentifully, in deep valleys or ravines where the banks of the stream become boggy and grassy, forming a wet open glade. From time to time it is found in unusual abundance.

Habits.—The grass nymph is so very local that unless one happens to hit upon just the right locality it is likely to be overlooked.

This butterfly has a very irregular, languid, dancing flight, rising but a foot or two above the grass tops. It especially loves to flit through buttonbush and clumps of alder growing in the bogs, and it is most active just within the borders of the woods adjacent to the bogs in which it lives, where, however, only the males are to be found. Here it flies more strongly and higher than in the open, and is much more wary and alert. Here only it seems to play. In the mottled shade two belligerent males will sometimes rise fluttering to a height of 10 feet or more, though in the grassy areas the butterflies seem to pay little or no attention to one another, no matter how numerous they may be.

When frightened the grass nymph either rushes off with a very rapid, direct, and rising flight, which is its usual habit in the woods, or darts to cover in the interior of a bush, or after a short dash drops into the grass and there conceals itself.

In general, the actions of this butterfly are much like those of the wood nymph. It has the same quick, nervous motions, and when sunning itself usually sits side to the sun with its wings tilted at right angles to the rays, but occasionally back to the sun with the wings partially expanded.

Season.—This butterfly first appears in the first week in June, becomes common by the middle of the month, and is found in greatest abundance in the middle of July. Toward the end of July the numbers decrease, but it remains on the wing until nearly the middle of August. Mr. Shoemaker writes me that he has found it quite common along the Eastern Branch about the middle of June, and one of the two specimens from the District in the Schönborn collection is dated June 15. I found it very common on July 15 and 23 in the bog at Beltsville, where there were still a few much-worn individuals on August 5. Mr. Shoemaker has a specimen which he caught on the Eastern Branch on September 23, 1927.

About Boston this insect, according to Mr. Scudder, usually appears about July 7, occasionally as early as the 1st or as late as the 15th. Generally it is abundant by the middle of July. Toward the end of the month it is much less common, and also badly torn and rubbed, but it continues until after the middle of August.

In the vicinity of the District, therefore, while the insect first appears a month earlier than about Boston, its period of maximum abundance is approximately the same in both regions, or possibly very slightly later here.

It would seem most probable that Mr. Shoemaker's unique very late capture was an individual from an egg laid in the spring of the same year.

Notes.—Compared with a series of 24 specimens from Weston, Mass., near Boston, the individuals from Beltsville are seen to be uniformly darker and more grayish.

The Massachusetts specimens (pl. 1, figs. 5, 6) all are of a somewhat yellowish brown, whereas those from Beltsville (pl. 1, figs. 3, 4) are of a smoky brown. These last are above more nearly the color of *Neonympha eurytus* than of that of the form of their own species occurring about Boston.

As in the north, the depth of color varies considerably. Though the males are always quite dark and smoky, the lighter females are only slightly grayer and scarcely darker than some northern females.

In both series of specimens the males sometimes lack all trace of spots on the fore wings, while in the females the uppermost spot on the hind wing may be extended outwardly, tapering to a sharp point.

In light southern females the light area on the outer third of the fore wings is bounded by the row of four rounded spots, and the apex of the wing is always broadly dark, the light band beyond the end of the cell being seldom more than half its width. In light northern females this light area extends beyond the four rounded spots nearly or quite to the narrow submarginal band and sometimes involves nearly the whole of the apical portion of the wing.

It is evident that the specimens from Beltsville show an approach to the form described as *fumosus* by Leussler, although the deviation from the northern type is not very great either in color or in size.

In 7 males from Beltsville the fore wing varies in length from 25 to 27 mm., averaging 26 mm.; in 3 females the minimum is 25, the maximum 27, and the average 26 mm.

In 12 males from Weston, Mass., the fore wings varied in length from 23 to 26 mm., averaging 24 mm.; in 12 females the minimum is 24, the maximum 28, and the average 25.8 mm.

Remarks.—In Lincoln, Mass., I once frightened one of these butterflies, which dashed away in almost a straight line, rising as it went. It had not gone more than 10 feet when it was seized by a dragonfly, which at once lit on a fern frond and was immediately caught. The butterfly seemed quite dead. It had been beheaded and the hind wings had been torn by the legs of the dragonfly during capture.

Genus CERCYONIS Scudder

CERCYONIS ALOPE ALOPE (Fabricius)

Goggle Eye

Plate 3, Figures 3, 4

Occurrence.—Locally distributed and usually infrequent, but in a few localities common. It is found very sparingly along the edges of the fields from Cabin John to Great Falls, along the edges of the woods in Rock Creek Park, and along the wooded borders of the fields at Silver Spring. In the low grassy lands along the Eastern Branch and in the meadows at Beltsville it is common near the edges of the woods, and also for some distance within the woods themselves wherever there is a considerable growth of pines.

The goggle eye frequents grassy hillside meadows dotted with bushes and cedar trees, more or less damp pastures in which it keeps rather closely to the hedges, shrubbery, or the borders of woodland, and open woods, particularly where pines are common. Sometimes, when very abundant, it will wander widely out over grassy fields and meadows.

Habits.—In this region the goggle eye is more of a woodland butterfly than farther north, and it is most abundant along overgrown wood roads and in glades and clearings along the Eastern Branch. In this district it is also common in the fields close to the borders of the woods.

It is alert, wary, and very quick, being, perhaps, the most difficult of all the local butterflies to catch. It has a strong, highly irregular, jumping flight, and is particularly fond of perching on the trunks of trees, especially pines, about 5 feet above the ground, head down, the wings closed, and the fore wings drawn well out so as to expose the eye spots. In this position it will not permit of a close approach, and if startled dodges around the trunk and makes rapidly off, keeping the trunk between itself and its pursuer. If startled it will often dash into a tangled mass of brambles or other herbage and perch on a twig, exposing its eye spots to the full.

Frequently it will alight in its impetuous manner upon a stone, log, or leaf, or even on the bare ground, immediately turning so as to bring its closed wings at right angles to the sun's rays, then suddenly inclining so that the sun's rays fall perpendicularly upon them. More rarely it turns so that its closed wings are parallel to the sun's rays, in which position it casts no shadow. If suspicious of danger it is very careful to keep the eye spots exposed to the full.

When in open fields, away from woods or bushes, it has a languid, dancing flight much like that of the grass nymph, though stronger. If frightened it flies rapidly and wildly for a variable distance and drops into the grass, where, relying too strongly on the effect of its eye spots on the pursuer, it is readily caught.

Wherever possible, this butterfly spends the night in the interior of thickets, hanging from a branch, or beneath the branches of small trees, preferably pines. But in extensive meadows it spends the night clinging to the underside of grass blades some distance from the tip.

This species in the District area is noticeably more active and alert than it is in eastern Massachusetts. In both regions the females keep mostly to the borders of the woods or near the bushes in brushy fields. The individuals found in the woods among the trees are, so far as I have seen, always males, and those that wander out over grassy areas at some distance from the woods seem to be chiefly males.

I have observed (in Massachusetts) many individuals in open pastures settling themselves for the night. The butterfly alights abruptly on the upper surface of a grass blade with the body horizontal, or making various angles up to about 60° with the horizontal. The wings are closed above the back, and the fore wings are drawn out so that both the eye spots, or the anterior and the anterior part of the posterior, are exposed. Usually at intervals of about once a second the wings are opened spasmodically to an angle of about 90° and at once closed again. After a longer or shorter time the butterfly walks slowly downward toward the roots of the grass until rather near the ground, passes to the lower side of the blade, suddenly draws the fore wings in between the hind wings, and is now prepared to spend the night. Some of the butterflies, however, simply moved to the underside of the blade from their original position.

The psychological effect of watching this rather prolonged performance is most curious. After the butterfly has remained quite motionless for some minutes it seems to dissolve into the background, and one becomes conscious solely of the staring eye spots, which seem to increase in size and to acquire a most forbidding aspect.

In grassy regions individuals frequently are captured with a neat angle cut symmetrically from the edge of both fore wings of which the apex reaches to or penetrates an eye spot. I have even taken a specimen with an angle cut to each eye spot. These nicks are made by the beaks of song sparrows, or other grass-frequenting birds, which apparently have been fascinated to the point of investigating the uncanny apparition.

Both this species and the grass nymph often get their wings very badly cut and torn through flying out of the dense thickets or up from the grass where they have spent the night, or from being blown when resting against neighboring grass blades by a sudden wind. But the little wood nymph, which spends the night on the underside of leaves of low isolated plants growing in the woods, seldom has the wings mutilated, though their upper surface may be very badly rubbed.

So far as I have seen the mating of this butterfly takes place only along the borders of grassy areas adjacent to woods or bushes.

I once had an opportunity of watching part of the courting performance of this butterfly, which took place late in the afternoon. A male, startled from the grass, flew to the trunk of an alder on which it perched transversely, with the wings perpendicular to the trunk. On the same trunk but on the opposite side, a female was resting, also perched transversely. Her wings were closed above the back, and the fore wings were partially withdrawn so that only one of the eye spots was visible. Immediately after alighting the male turned completely around and walked in a series of rapid jerks around the trunk in the direction of the female, constantly opening his wings to an angle of about 90° and snapping them shut again. When his wings were closed the fore wings were drawn out so that both the eye spots were exposed. The female, approached from behind, showed no interest. When nudged by the male she simply moved slightly. The male finally ceased opening and closing his wings and moved to a position directly alongside and above the female, both of them remaining motionless.

Season.—This butterfly first appears during the first week in July, or rarely during the last week in June (in 1930 on June 29), but it does not become common until between July 15 and 20, when it rather suddenly appears in considerable numbers. It remains common during the first half of August, after which its numbers decrease. The males disappear about the first and the females about the middle of September. My last record is September 15, when I saw a much battered though still very active female at Silver Spring. The females first appear four or five days after the first males. Of the six specimens in the Schönborn collection two were taken on July 9 and one on July 11.

About Boston this insect appears, according to Mr. Scudder, on July 10 or 12. It continues to emerge through July, remains abundant throughout most or all of August, and may be found until the middle of September. In southern New England it appears, as in the District, early in July.

About Boston I have found that the males disappear very early in September when the females are still common, but at Ipswich, Mass., I have taken fresh males as late as August 28.

Although casual individuals appear in the District somewhat earlier than in the vicinity of Boston, the main emergence takes place here about a week later.

Notes.—Some individuals of this butterfly have the band on the fore wings very dark (*maritima*, pl. 3, figs. 1, 2), while in others the band is an almost pure white, as in the form (pl. 3, fig. 4) that alone occurs in the mountain valleys of southern West Virginia and the Carolinas. In occasional males the lower eye spot within the yellow band on the fore wings is reduced to a dot, as is sometimes the case in eastern Massachusetts. If caught nearer the sea such specimens would be properly considered as referable to the southern coastal form *pegala* (pl. 2, figs. 6–8).

It has not been possible to secure a sufficient series of specimens of this insect to warrant any very definite statements about it. But from observations in the field—this butterfly is far more easily observed than caught—the typical form is the most common, the *maritima* form is locally frequent, the white-banded form is rare and is confined to the woods above Cabin John, and the *pegala*-like males are exceptional and occur only with the *maritima* form.

CERCYONIS ALOPE MARITIMA (Edwards)

Plate 3, Figures 1, 2

This form, conspicuous on account of its very dark color and especially the deep shade of the band on the fore wings, is locally frequent in pine woods along Paint Branch and the Eastern Branch and in the adjacent territory. In the limited areas where it is found it usually predominates over the typical form. It first appears nearly or quite a week in advance of the latter.

In the males the lower eye spot in the yellow band on the fore wings is sometimes reduced to a dot showing an approach to *C. a. pegala* (pl. 2, fig. 6).

NOTE

In addition to the species of Satyrinae given in the preceding pages, the following should be looked for in this region:

Neonympha gemma (see p. 243).
Neonympha phocion (see p. 243).
Neonympha sosybius (see p. 244).
Cercyonis alope pegala (see p. 244).
Enodia portlandia (see p. 244).

Subfamily NYMPHALINAE

KEY TO THE SPECIES

a^1 Hind wings with the outer margin devoid of any processes, except that there may be a slight tooth near the anal angle.
  b^1. Hind wings beneath with many conspicuous silver spots.
    c^1. Larger, the fore wings more than 30 mm. long.
      d^1. Fore wings above reddish orange with delicate black markings; hind wings above purplish black, with two

rows of spots, both white (female), or the outer orange and the inner white (male) (pl. 13, figs. 1, 2; pl. 14, fig. 1) ------------------------ **Argynnis idalia** (p. 104).

d^2. Both fore and hind wings above brownish golden with black markings.

e^1. Underside of hind wings with the light-yellow submarginal band broad, occupying the entire space between the two rows of silver spots; no reddish tint on wings above (pl. 15, figs. 1, 2) - **Argynnis cybele** (p. 109).

e^2. Underside of hind wings with the light-yellow submarginal band very narrow and more or less interrupted; hind wings above with a slight reddish tinge toward the base (pl. 16, figs. 1, 2; pl. 17, figs. 1, 2) ------------------------ **Argynnis aphrodite** (p. 112).

c^2. Smaller, the fore wings less than 25 mm. long; wings above orange with a black border and fine black markings (pl. 3, figs. 5, 6) -------------------- **Brenthis myrina** (p. 102).

b^2. No silver spots on the underside of the hind wings.

c^1. Rather large, with the fore wings more than 35 mm. in length.

d^1. Wings above lustrous black, the hind wings broadly bordered with dark metallic blue or green (pl. 5, figs. 1, 2).
Basilarchia arthemis astyanax (p. 76).

d^2. Wings above light brownish orange or red, with the veins, a narrow band across the hind wings, and the outer borders black (pl. 6, fig. 1) -- **Basilarchia archippus** (p. 78).

$c.^2$ Medium sized or small, with the fore wings not so much as 35 mm. in length.

d^1. Medium sized, with the fore wings more than 20 mm. in length.

e^1. Wings above blackish, or very dark brown, the fore wings crossed by an orange-red band beyond which are some white spots, and the hind wings broadly bordered with orange-red (pl. 7, figs. 5, 6).
Pyrameis atalanta (p. 84).

e^2. No orange-red band across the fore wings.

f^1. Wings above velvety black with numerous small white or light yellow spots and broadly margined with brick red (pl. 11, figs. 7, 8) -- **Euphydryas phaëton** (p. 100).

f^2. Wings not black above.

g^1. Portion of lower surface of fore wings covered by the hind wings when at rest bright pinkish marked with black; wings above golden or pinkish orange, the apex of the fore wings black with a few white spots and their inner half irregularly marked with black.

h^1. Hind wings below with two large eye spots, each broader than an interspace, situated near the margin in a broad band bordered with white interiorly; fore wings below mostly bright pink (pl. 27, figs. 1, 2).
Pyrameis virginiensis (p. 86).

*h*². Hind wings below with a submarginal row of at least four eye spots, which are never broader than an interspace; fore wings below mostly pinkish orange (pl. 8, figs. 1–3) _ **Pyrameis cardui** (p. 88).

*g*³. Fore wings below dull and brownish, light or dark; wings above dull brownish, light or dark, variously marked.

*h*¹. Hind wings above with two large eye spots, each much broader than an interspace, the anterior the larger; fore wings with a large eye spot near the lower angle, from which a whitish band runs to the costal margin, and with two red narrowly black-bordered bars across the cell (pl. 7, figs. 1–4) __ **Junonia lavinia** (p. 79).

*h*². Hind wings above with a submarginal row of 4, 5, or 6 dark oval spots, none so broad as an interspace; fore wings with 2 or 3 blackish bars across the cell, and no white band.

*i*¹. Fore wings without submarginal dark oval spots, or with a single one near the lower angle; fore wings lighter or darker than the hind wings, and with numerous white or very light spots.

*j*¹. Upper surface grayish brown, darkest on the fore wings; fore wings with numerous white spots and a dark oval spot narrowly ringed with yellowish toward the lower angle; hind wings with six submarginal dark oval spots (pl. 4, fig. 4).
Chlorippe celtis (p. 74).

*j*². Upper surface orange or yellowish brown, becoming darker on the hind wings; fore wings without white spots, and with no oval spot toward the lower angle; hind wings with five large dark submarginal oval spots (pl. 4, figs. 1–3) __ **Chlorippe clyton** (p. 75).

*i*². Fore wings with a row of five submarginal dark oval spots; fore wings of the same shade and with the same color pattern as the hind wings (pl. 21, figs. 1, 2).
Euptoieta claudia (p. 114).

*d*². Small, the fore wings not so much as 20 mm. in length; above orange with numerous fine black markings.

*e*¹. Undersurface of hind wings usually with a very varied ground color, large patches of dark contrasting strongly with a lighter base; a large more or less clouded dark marginal patch in the middle of the hind border invariably present and generally very distinct (pl. 7, fig. 7; pl. 13, fig. 5) ___ **Phyciodes tharos** (p. 97).

*e*². Undersurface of hind wings very uniform, all the markings delicate and almost obsolete; marginal patch of the hind border, if present at all, obscure (pl. 13, figs. 3, 4) _________________ **Phyciodes batesii** (p. 100).

*a*². Hind wings with a conspicuous process, a long round-tipped tooth or narrow tail, on the outer border not far below the middle; fore wings with a prominent angle between one-fourth and one-third of the distance from the apex to the lower angle.

  *b*¹. Upper surface of wings deep maroon with a broad yellow outer border immediately followed by a row of small bright blue spots (pl. 9, figs. 1, 2) ____________ Vanessa antiopa (p. 91).

  *b*². Upper surface of wings brownish red, hind wings more or less extensively dark brown and the fore wings bordered with dark brown; light areas on both wings with dark brown spots.

    *c*¹. Larger, with the fore wings about 30 mm. in length or longer; center of undersurface of hind wings with a silver semicolon; basal quarter of costal border of fore wings beneath conspicuously mottled with pale yellow and brown; wings narrowly edged with pale violet (pl. 10, fig. 3) ______________________ Polygonia interrogationis (p. 94).

    *c*². Smaller, with the fore wings about 26 mm. long; center of undersurface of hind wings with a silver boomerang-shaped mark; basal quarter of costal border of fore wings beneath transversely streaked with brown and paler brown, not strongly contrasted with the adjacent parts; wings without violet edging.

      *d*¹. Silver boomerang-shaped mark in the center of the hind wings below suddenly expanded at each end (pl. 11, figs. 3, 4) ___________________________ Polygonia comma (p. 95).

      *d*². Silver boomerang-shaped mark in the center of the hind wings below sharply pointed at each end (pl. 11, figs. 1, 2) ___________________________ Polygonia progne (p. 97).

Genus CHLORIPPE Boisduval

CHLORIPPE CELTIS CELTIS (Boisduval and Le Conte)

HACKBERRY BUTTERFLY

Plate 4, Figure 4

Occurrence.—Very local, but often common in a very restricted area. Mr. Shoemaker has taken it in Rock Creek Park and in Arlington County, Va., and I have found it at Arlington, Va., at Plummers Island, Md., and in two places in the woods along the canal 2 miles beyond Cabin John.

It is found in open deciduous woods, especially in open glades and along woodland roads.

Habits.—As a rule this butterfly keeps high up in the trees, and it is most often noticed from 10 to 15 feet or more above the ground, playing about the ends of branches, perching on the leaves, or darting from one place to another. It is wary and quick and has a very rapid flight, which is never long, and it seems very reluctant to leave its restricted haunts.

Although usually to be seen about the higher branches of the trees, and especially perched on the upper surface of the outermost leaves, these butterflies are occasionally noticed on the leaves of low herbaceous plants growing in the clearings, and even on the ground. They delight in resting, head down, on the trunks of trees, like the angle wings, and if disturbed will frequently alight upon one's clothing, or on the rim of the net. I once watched an entomologist searching for this species with a fine example perched upon his cap.

The hackberry butterfly is fond of sucking up water from muddy spots in roads, is very fond of the juices of decaying fruit, and is inordinately fond of decaying flesh or filth. Any animal carcass has an irresistible attraction for it, and it is most readily captured by baiting with a dead snake or other creature placed in a clearing in the woods.

Seasons.—The hackberry butterfly is two brooded, the first brood, which consists of few individuals, appearing in the first half of June, and the second, which is far more numerous, appearing after the middle of August and becoming most abundant early in September. I have specimens taken on June 16 and on September 2, 6, 8, 11, and 29, and Mr. Shoemaker has specimens taken on August 20 and on September 2 and 3.

CHLORIPPE CLYTON CLYTON (Boisduval and Le Conte)

TAWNY HACKBERRY BUTTERFLY

Plate 4, Figures 1 to 3

Occurrence.—Very local and apparently uncommon. I have three specimens, a dark male (pl. 4, fig. 3) and a dark female (pl. 4, fig. 2) taken in an open grassy area in a patch of woodland along the canal 2 miles west of Cabin John, where they were flying in company with numbers of the preceding species, and a light female (pl. 4, fig. 1) caught on a willow in a field about half a mile away.

Habits.—This species is less active and less wary than the preceding and correspondingly more easy to catch.

Seasons.—My specimens were taken on September 8 and 11, 1926. It is presumably two brooded in this region, occurring with the preceding species in June and again in the latter part of August and in September.

Note.—Since the preceding account was written, two additional males have been taken. A freshly emerged dark individual was picked off the trunk of one of the pin oaks in the 1800 block of Wyoming Avenue, Washington, on August 16, 1931 (Hugh U. Clark), and when in company with Foster H. Benjamin on September 14, 1931, I took a very worn light specimen at Cabin John very near the locality where the light female was caught.

Genus BASILARCHIA Scudder

BASILARCHIA ARTHEMIS ASTYANAX (Fabricius)

Black Admiral

Plate 5, Figures 1–4

Occurrence.—Very generally distributed, occurring in open deciduous woods throughout the District and the surrounding country, but nowhere numerous, being usually noticed as single widely separated individuals. It is occasionally to be seen about the trees in the Smithsonian Institution grounds, and was formerly to be found about fish, cabbages, or fruit in Center Market.

Habits.—This fine butterfly is usually seen along the borders of partially shaded woodland roads, and sometimes along the edges of woods or shrubby roadsides. It usually keeps well above the ground, from 6 to 8 feet or more, and is rather shy and difficult to catch. It has a leisurely and stately flight, turning and twisting about, flapping and sailing alternately, and unless disturbed never wanders far from a given spot. If frightened it rises high in the air and makes off very rapidly through the trees, but sooner or later it usually returns to its favorite locality. Females are sometimes seen traveling in a direct line with a continuous flapping of the wings 6 or 8 feet above the ground over open fields from one patch of woodland to another, but I have never caught a male making such a flight.

This butterfly is very fond of sunning itself on the upper surface of a leaf with the wings partially extended, and also of simply resting on a leaf with the wings closed above the back.

It is often seen on muddy spots in roads sucking up the moisture. It is extremely fond of carrion and of filth of all descriptions, and decaying carcasses will attract it from a long distance. Like other carrion-feeding butterflies, it is very easily caught about a carcass.

Seasons.—This butterfly appears very sparingly about the middle of May and becomes common toward the last of the month. Fresh individuals continue to emerge through June and well into July. In the middle of July the second, more abundant, brood appears, the individuals continuing to emerge until well into August. About the first of September fresh individuals again appear, and these become common in the middle of the month.

This species is to be found flying in varying numbers throughout the summer, from the middle of May until the second week in October. It is rather scarce early in summer, common in the last week in July and during the first half of August, and most numerous in the last half of September.

The specimens in the Schönborn collection are dated May 6, 8, and 13; they were evidently raised. The National Museum contains a specimen taken by D. H. Clemons in Rock Creek Park on October 11, 1908.

Notes.—This butterfly was unusually common in the summer of 1928, but was very scarce in the summer of 1929 and of 1930.

Remarks.—Good specimens of this fine insect are easily secured by gathering the little shelters in which the caterpillars spend the winter and raising them to maturity in spring.

In a series of 12 specimens from the vicinity of Boston (pl. 5, figs. 3, 4) the undersurface of the hind wings within the submarginal series of dull orange spots is rusty brown with, except in a single instance, no trace whatever of metallic luster. There are usually two or three bluish spots at the base of the wing, which, however, are scarcely metallic. The ground color of the apical portion of the fore wings is the same as that of the hind wings; that of the inner portion is usually darker and less rusty. In some cases the difference is slight, while in others this area shows a distinct, though faint, greenish luster. There are two lusterless greenish spots, one on either side of the inner reddish cell spot near the costal margin, and sometimes the entire cell will be thickly studded with greenish scales. The upper surface of the wings is more or less distinctly brownish, especially the apical portion of the fore wings, and the hind wings and inner portion of the fore wings are only faintly, or scarcely at all, lustrous. The reflections are dark and often more or less bronzy greenish, more rarely purplish. Occasional specimens have a distinct metallic luster over the entire undersurface of the hind wings and inner portion of the fore wings, and a faint luster on the entire upper surface, except for the apical portion of the fore wings.

In specimens from the District (pl. 5, figs. 1, 2) the hind wings beneath are usually a dark highly lustrous greenish except for long, very dark, rusty-brown intersticial spots between the veins, and all but the apical portion of the fore wings is lustrous greenish black. Above the wings may be wholly lustrous greenish black except for two elongate deep maroon intersticial spots near the apex of the fore wings, or the apical portion of the fore wings may be more or less extensively brownish. The luster of District specimens is usually more bluish than that of northern examples. As a rule the hind wings of local specimens are less regularly rounded and more distinctly subangulate than are those of specimens from the vicinity of Boston. The latter almost invariably retain a slight trace of the white bands of the typical form. In District specimens this is reduced to a narrow white streak on the costal border of the underside of the fore wings, and on the fore wings above a narrow greenish or whitish streak on the lower border near the angle with two greenish spots above it.

The local form of this butterfly is more or less midway between the form found in southern New England and New York and the form occurring in Arizona (*arizonensis*), though slightly nearer the former.

BASILARCHIA ARCHIPPUS ARCHIPPUS (Cramer)

VICEROY

Plate 6, Figure 1

Occurrence.—Locally distributed, but usually common where it occurs, and in some places abundant. It is found in moist meadows with small scattered willows, on hillsides with a growth of small poplars, and, when numerous, along roadsides. It occurs frequently in the open fields along the Eastern Branch where willows or small poplars grow, in moist hollows with willows at Silver Spring, and abundantly in the meadows 2 miles west of Cabin John, where late in summer it is to be seen especially along the roads.

Habits.—In life the viceroy is not nearly so similar to the monarch, or milkweed, butterfly (*Danaus plexippus*, pl. 6, fig. 4) as it appears in collections. The monarch is a wanderer over open and more or less flat country, while the viceroy keeps rather strictly to moist hollows in meadowland, or to certain spots in scrubby hillside pastures, or to bushy roadsides. The flight of the two is very different. The lazy flapping of the monarch alternating with a seesawing glide, during which the wings are held at an obtuse angle with each other, is readily distinguishable at any distance from the quicker and more nervous flapping of the viceroy and its straight glides with the wings held horizontally.

Where it is few in numbers the viceroy is a rather inactive butterfly, and the females are always more or less inert. It spends much of its time resting on a leaf with the wings closed, and it is often seen sunning itself with the wings horizontally expanded and the fore wings drawn well back. When startled it seldom flies far, and as it is not very shy it is easily followed and captured. The males constantly make little excursions, flying out for 100 feet or so over the open fields and then returning. Because of its inertness it may pass unnoticed even when it is really rather common. If present it may readily be found by beating the willow bushes and adjacent herbage, which causes it to reveal itself.

When abundant, however, and especially at the end of the season, it becomes quite a different butterfly. The males leave their home areas and are found scattered along the roads, basking in the sun, fighting with one another, and darting savagely at any large grasshopper or dragonfly or other insect that comes near. If startled they fly out over the fields at a height of 3 or 4 feet above the ground, but soon return to the road again, often at a considerable distance—100 feet or so—from where they left it.

These roadside males are rather shy and difficult of approach, especially if resting on the ground. But they seem to feel safe upon the wing and as a rule are easily caught as they fly by. One must be rather quick, however, as they are very agile and are likely to dodge the net. Practically all of them have more or less broken wings.

Good specimens of this butterfly are easily secured by raising them from the caterpillars, which are common and easily found. They are to be looked for about the middle of May or in the last half of July or later near the tips of the branches of small isolated willows or poplars. The caterpillars found on willow are of various delicate shades of green, while those found on poplar are much darker and largely brownish. Mr. Scudder long ago noticed the difference in the caterpillars found on these two food plants in New England, and it seems to be equally marked here.

Seasons.—The viceroy first appears about the middle of May and becomes common in June and early in July. Later in July fresh individuals appear, flying together with worn examples of the first brood. From this time on throughout the summer it is always to be found, and its numbers gradually increase, reaching a maximum about the middle of September. It disappears in the second week in October. The butterflies seen late in September and in October probably are representatives of both a second and a third brood, for late in July both worn and fresh butterflies are on the wing, while the caterpillars are to be found in all stages. There is a specimen in the National Museum taken on willow September 8, 1899.

Genus JUNONIA Hübner

JUNONIA LAVINIA COENIA (Hübner)

BUCKEYE; AMERICAN PEACOCK BUTTERFLY

Plate 7, Figures 1 to 4

Occurrence.—Not very numerous until after midsummer, when it becomes common, and late in summer in some years very abundant, throughout the District.

The buckeye is most frequent in hot dry areas, especially if exposed to winds, along open roads, and in moist fields or marshy hollows in open country. In some years late in summer it is often seen in all the parks and open spaces in Washington, and occasionally in the busiest of the city streets. I have a fine specimen that I captured on June 30, 1928, on the corner of Fourteenth and F Streets while waiting for a street car.

There are three specimens in the National Museum taken on August 2, 1919, August 28, 1899, and October 14, 1914, the last by W. H. White, in Washington.

Forms.—The two forms of this butterfly found in the District and vicinity are, when typically developed, widely different.

In one (pl. 7, figs. 1, 2), the fore wings are about 30 mm. long in the female and about 28 mm. long in the male. On the upper surface the ground color is dark, and the brown of the fore wings and of the outer half of the hind wings sometimes shows dark green metallic reflections. On the underside the whole of the hind wings and the apical portion of the fore wings is dull pinkish red, often quite uniform, but usually darkest in a long irregular narrow triangle bordered by irregularly crenulate lines running from a base near the outer angle of the hind wings to an apex near the anal angle. This triangle often contains two small oval blue spots narrowly ringed with lighter, or some trace of such spots.

This form has curiously soft wings and always feels as if it had recently emerged from the chrysalis. Its wings are rarely broken or torn, though they may be rubbed. It is sluggish, and rarely flies for more than 50 feet or so, alighting usually on the ground.

In the other form (pl. 7, figs. 3, 4), the fore wings measure about 27 mm. in the females and about 24 mm. in the males. The ground color above is lighter brown. Beneath the ground color of the hind wings and the apex of the fore wings is light gray, usually slightly tinged with buff, and there are two conspicuous oval black spots about as broad as, or narrower than, an interspace, which are narrowly ringed with buff not far from the outer margin of the hind wings.

In this form the wings are dry and brittle, and nearly all the individuals caught are nicked or more extensively damaged. This form is exceedingly alert and active, a much stronger flier than the other, and if alarmed flies rapidly away, usually not pausing until it is out of sight. It is fond of flowers, and if it rests it always chooses the summit of a tall weed or a tall dead stem or bare ground from which it can easily dart in any direction.

In 1926 I wrote that the form with the underside of the wings dull pinkish red is the commonest about Washington in the fields where the food plant (*Agalinis purpurea*) is abundant, while the small light active form is found sparingly with the other. I remarked that the small light form differs from the larger and darker one in keeping mostly well above the ground, resting on the tops of the higher plants and darting off at the slightest provocation, and that it is much more frequently to be seen on barren hillsides, about the city parks and streets, and generally in unfavorable localities. I added that it is this form that occurs in New England.

I suggested that the small light form is a special form particularly fitted for long-continued flight and therefore especially adapted for distributing the species.

These remarks were based on observations made early in the autumn of 1925 in the fields along the Conduit Road 2 miles beyond Cabin John. Here the large dark form was very abundant, and 30 or 40 or more could easily be started from the grass and captured in the course of a couple of hours. The caterpillars were very common, and a number were raised, all coming out the dark form. The small light form was very scarce.

Since that year I met with no typical examples of the dark form until late in the summer of 1929, when it again appeared, though in small numbers.

The earliest date for the large dark form is September 9.

I have been unable to find the dark form elsewhere in the vicinity of the District. But intermediate specimens showing an approach to it in all ways are frequent late in summer in the low, damp hollow at Silver Spring, parallel to and near Blair Road, just opposite the entrance to the Hyslop estate, while in the higher and drier regions in the same fields the small light form is common.

Carl Heinrich examined the male genitalia of typical examples of these two forms and found no differences.

Habits.—This butterfly has been given by some authors (for instance, Maynard and Scudder) as frequenting dry, hot places, and by others as found in fields near swamps (John Abbot), or preferring meadows and lowlands (F. H. Sprague). From my experience with it I am inclined to believe that it occurs equally in both types of localities, but tends in the moist areas to develop a special local and relatively inactive form. In Massachusetts, where only the small light form occurs, I have taken it on the hot sand dunes at Ipswich and also in a boggy hollow in some extensive hilly pastures at Essex.

The buckeye has a rapid, direct flight, alternately flapping with a few quick and nervous wing beats and then sailing for some distance with the wings held horizontally. Its usual rate of progress is 12 miles an hour, but when much frightened or in pursuit of some other insect it will fly at the rate of 15 or 16 miles an hour for 50 feet or more. After going a greater or lesser distance in a straight line it often turns abruptly to the right or left so that it is difficult to follow with the eye. It always flies low, from 4 or 5 inches to a foot above the grass tops, and between 1 and 2 feet above open and bare ground. In flight the light form sometimes appears more like a grasshopper than like a butterfly.

It is very fond of flowers, especially those that rise some distance above the grass, and shows a marked preference for white flowers, such as those of the wild carrot or the boneset. It is also especially fond of the blue flowers of *Eupatorium coelestinum*. When it is feeding, the wings are usually partially expanded, though they may be closed. It is also very fond of sunning itself with the wings partially expanded on the tall dead stalks of weeds and on stones.

The males are much shier and much more active than the females. The females usually keep to the grassy areas over which they are more or less uniformly distributed. Mating occurs only in the open grassy regions.

When abundant the males frequent the bare dirt roads. Here they fly back and forth or sun themselves with their wings touching the ground or held at a slight angle with it. Their sight is very keen, and they become suspicious of an intruder at a distance of from 15 to 20 feet. If one walks at the usual rate they will take wing at a distance of about 10 feet, but by walking slowly one can approach to within about 5 feet.

They are exceedingly pugnacious and dart at once at large flies, wasps, bees, other butterflies, or anything else that comes near their line of flight or passes within 6 or 8 feet of them as they sit upon the ground. They are also very quarrelsome among themselves. There is a constant feud between them and the males of the pearl crescent (*Phyciodes tharos*), which swarm in the moister spots along the roads. But these pugnacious little butterflies often turn on the much larger bully, which in that event always beats a hasty retreat. Sometimes, however, the two may be found together on the best of terms sucking moisture from the mud.

Both sexes of the small light form of this butterfly are very adept at hovering. The male is sometimes seen hovering with very rapid wing beats about a female, somewhat as a sphingid moth hovers about a flower cluster. The female is occasionally noticed slowly winding about after the fashion of the hovering skipper (*Poanes massasoit*) in the interior of bushes or thick herbage.

Perhaps the most interesting peculiarity of the buckeye is its intense dislike of the common Carolina locust (*Dissosteira carolina*). If one of these clumsy insects jumps up and takes to flight and there is a male buckeye near, the latter at once gives chase, flying behind, above, or on either side of it, but always keeping from 2 to 4 inches away. If the locust alights on the road the butterfly alights simultaneously 4 or 5 inches to one side and slowly waves its wings in a menacing fashion. If the persecuted locust takes off again, the butterfly is after it once more. If a locust pursued by a buckeye passes within 10 feet or so of another buckeye, buckeye No. 2 joins the pursuit, and sometimes a third will join. But when the locust alights, only one of the butterflies alights near it. While several of the local butterflies habitually and persistently persecute this locust, by far the most enmity and perseverance are shown by the buckeye. A Carolina locust pursued by a buckeye and trying to escape is a sight that may be witnessed a hundred times a day wherever these butterflies and these locusts are common.

Frequently the buckeye will turn from its course and follow grasshopper and Henslow's sparrows (*Ammodramus savannarum australis* and *Passerherbulus henslowi sussurans*) that fly up from the grass. But it is not swift enough to catch up with them, and they seem to pay no attention to it.

Late in summer barren spaces in hillside fields where male buckeyes congregate are kept almost completely free of other species by their aggressive actions.

Notes.—The local variation in this butterfly, elsewhere remarkable for the extent and diversity of its aberrations, is surprisingly slight. Occasional individuals are met with in which the light band on the fore wings is entirely obliterated, being replaced by brown, and the eye spots and other markings are rendered more or less indefinite by an admixture of brown scales. Slight irregularities in the form of the eye spots, especially the development of an angle on one side of the eye spot on the fore wing, are frequent. There is some variation in the relative size of the posterior eye spot on the hind wing, though this is never much reduced.

A specimen in the National Museum taken by S. D. Nixon at Baltimore, Md., has the spots on the upper surface of the hind wings enlarged and confluent.

Seasons.—In the District the buckeye has three broods a year. The first brood, composed of relatively few individuals, appears in the first week of June, the numbers slowly increasing and reaching a maximum in the last half of June and early in July. The second brood appears toward the end of July while worn individuals of the first brood are still on the wing, and extends well into August. The third brood appears during the last week in August, and the butterflies of this brood increase in numbers until after the middle of September. The butterflies of the second brood are more numerous than those of the first, and those of the third are much more numerous than those of the second, being in some years very abundant. The butterflies of the third brood are seen sunning themselves on warm days late in October, occasionally in November, and rarely early in December, in which month I have noticed them on the parking space at the western end of the New National Museum building. These butterflies hibernate, but only a very few of them, all of the dry form with no pink on the underside of the hind wings, survive the winter. The few survivors reappear in the first half of May when ragged individuals may occasionally be seen on the flower beds in the Department of Agriculture grounds and elsewhere; they disappear early in June.

In 1929 hibernated individuals of this species were unusually common. The butterflies of the first brood were very common, and those of the third brood abundant. Nearly all the individuals of the second and third broods caught in the marshy fields west of Cabin John were curious in having a tapering pink stripe bordering the discal portion of the hind wing beneath.

Remarks.—This butterfly has an enormous range, occurring from the Northern United States and even southern Canada, where it is rare or casual, southward to Argentina. Within the United States it is fairly constant, but farther south it develops a most perplexing array of geographical, seasonal, and other forms.

Genus PYRAMEIS Doubleday

PYRAMEIS ATALANTA ATALANTA (Linnaeus)

RED ADMIRAL

Plate 7, Figures 5, 6

Occurrence.—Locally distributed, but in some places common. It is most numerous in the wetter portions of the fields between Conduit Road and the canal 2 miles beyond Cabin John, wherever the false nettle (*Boehmeria cylindrica*) grows, and in the damp woods between these fields and the canal. It is also common in the bog between the railroad station at Beltsville, Md., and the experiment farm of the Bureau of Animal Industry of the Department of Agriculture, and in the open country along Paint Branch. It is more or less frequent in similar situations elsewhere, and occasional individuals stray into Washington in autumn. I have seen a number of specimens from the District without precise locality, and Mr. Shoemaker has bred it from caterpillars found here. The larvae are easily found by looking for their little domiciles on the false nettle. The numbers of this butterfly vary considerably from year to year.

The National Museum contains two specimens from Washington, one of which is very large with the fore wing 36 mm. in length; the other was taken in June, 1920.

Habits.—In this region the red admiral is almost equally an open woodland and a moist meadow butterfly, as its chief food plant here, the false nettle (*Boehmeria cylindrica*), occurs with the same abundance in both situations. It is often seen to fly from the woods out over the open fields and from the fields into the woods.

In the woods it is active, alert, and suspicious, playing about the open glades or along the roads like the angle wings or winding in and out among the trees with a quick, irregular flight, usually 4 or 5 feet above the ground. But on occasion it will rise very high, up to the tree tops, soon darting down again. It is fond of pershing on logs or on the ground or head down on the trunks of trees, spreading its wings nearly to the full extent, closing them two or three times, then darting off again. It will often fly about an intruder, occasionally perching for an instant on his clothing. It is frequently to be seen sunning itself with the wings fully extended. It is rather sedentary and, like nearly all our woodland butterflies, is prone to remain in the same glade or clearing or along the same short stretch of road, if frightened away, returning after a greater or lesser lapse of time.

In the meadows it is less active, less wary, and less suspicious. Its flights as a rule are short, and it seldom rises more than a foot or so above the grass tops. If frightened it will either dash into a bush and perch on one of the innermost branches, or after a short and usually circuitous flight drop into the grass and hide.

In open fields with widely scattered small trees, the red admiral is fond of resting in the shade afforded by them, fluttering in and out among the lower branches and alighting on their under sides, or on the trunk, or sometimes on the ground beneath.

It is fond of flowers, though it is much less frequently seen on them than the two related species, for the reason that it is less of a wanderer and therefore is less likely to stray to flowery fields and gardens. It is especially fond of rotting fruit, and in autumn when it is most abundant it is a frequent visitor to orchards and to vineyards.

This butterfly is to some extent nocturnal. I have caught it at night flying about electric lights, and others have done the same. It has also repeatedly been taken at sugar bait prepared for noctuid moths.

Almost without exception the individuals of this species caught in the open have more or less torn and ragged, or at least rubbed, wings. I have caught specimens in which the hind wings were almost entirely torn away and which, as a result, had a curious hovering flight like that of the hovering skipper (*Poanes massasoit*). Quite frequently the hind wings will be nearly or quite half gone and the outer border of the fore wings will be worn off to just within the outer row of white spots and the lower outer end of the red band.

This mutilation, commonly attributed to birds, is due to the habit of spending the night deep down in the grass or in the far interior of thickets or of vines. A luxuriant growth of ivy on a wall is a very favorite place for a night's rest, and I have several times late in the afternoon in autumn watched individuals crawl into the vines covering the east wall of the Museum of Comparative Zoology at Harvard University. No matter how deeply the insect may crawl into a thicket or a mass of vines, it almost invariably flies out, and in this way rubs and tears its wings.

Seasons.—The red admiral appears in the second week of May, when ragged individuals that have survived the winter come from their hiding places. These early in June are joined by numerous fresh individuals from chrysalids that have lived over the winter. Fresh butterflies appear about the end of June and are common until well into August. The second brood appears toward the last of August, and fresh specimens continue to be seen until well into October or even November. The butterflies of this brood winter over as adults, and together with them many pupae winter over, giving forth the butterflies in late May or June. As the individuals of this species are long lived, it may be seen on the wing in greater or lesser numbers continually from late in spring until late in autumn.

Remarks.—It is almost impossible to secure good examples of this butterfly by catching them in the usual way. But the caterpillars are very readily found by searching for their nests on the false nettle (*Boehmeria cylindrica*), or on nettles, in any region where the butterfly is common, and are easily reared.

In wet localities this butterfly tends here, as elsewhere, to develop a large and richly colored form (pl. 7, fig. 5), blackish above and much darker below than the usual type (pl. 7, fig. 6), with the wing bands deeper orange and usually narrower. This form seems never to survive the winter. I have seen it on the wing as early as August 27 and as late as October 13, but have never found it in spring or early in summer.

The red admiral was very common in the summer of 1926, when in damp meadows the large, dark form was much in evidence. It was very scarce in 1927 and in 1928, but was common again in 1929, when the dark form reappeared, and also in 1930, though in this year the dark form was not seen.

Notes.—The northern form of this butterfly is the one found in the District. In Florida, and also in southern Europe and northwestern Africa, there is another form with the orange band across the fore wings narrower, commonly interrupted, and including a small circular white spot. This form, more or less typically developed, occurs north of the District near the coast, reaching New Jersey and southern New York.

PYRAMEIS VIRGINIENSIS (Drury)

AMERICAN PAINTED LADY

Plate 27, Figures 1, 2

Occurrence.—Rather common in open fields throughout the District and the surrounding country, usually varying but little in abundance from year to year.

It is most numerous in dry and more or less infertile fields, especially on exposed hillsides, but it is also common in rich meadowland or pastures wherever there are abundant flowers, especially the taller composites, such as thistles, ironweed, joe-pye-weed, boneset, asters, or goldenrod.

There is a specimen in the National Museum collection from Washington taken in June, 1920.

Habits.—The flight of this butterfly is rapid and irregular. It darts from side to side and from time to time suddenly changes its course, often coming back to the place from which it started. The flight of the males is more erratic than that of the females, and they will frequently rise in the air to a considerable height. It usually flies low, only a foot or so above the grass tops, a series of quick nervous flaps alternating with a short planing in which the wings are extended horizontally. It is sometimes seen flying in a straight line with a continuous flapping of the wings 10 or 15 feet above the ground. When it is engaged in feeding, its flight, though quick and irregular, is less nervous than at other times.

It is often seen playing about piles of rocks or the rocky summits of hills or the ends of the branches of trees adjacent to exposed rocky patches. About trees it usually keeps well above the ground, and its actions here closely resemble those of the hackberry butterfly (*Chlorippe celtis*).

The females are less active than the males, have a less irregular flight, and are less inclined to wander. They keep chiefly to the areas where the food plants grow. If frightened they often fly a few feet and drop into the grass or dodge into a bush after the manner of the red admiral, while the males, so far as I have seen, either fly swiftly away and are lost to sight or circle irregularly about, returning to a point near that from which they started.

When the butterflies are feeding, their wings usually are closed and the forewings are drawn well out, exposing the pink on the under surface; from time to time the wings are suddenly opened and again closed. Occasionally, however, an individual will feed with the wings partially extended.

When the insect is sunning itself on a leaf or on the ground, the wings are opened not quite to the horizontal.

When the two occur together this species is seen to be less generally distributed than the painted lady (*Pyrameis cardui*), but possibly this is because it is usually less abundant. It keeps mainly to the fields and meadows, freely visiting gardens, although it is common on barren rocky hillsides wherever the food plant is abundant. Here it suns itself on the bare rocks after the fashion of *P. cardui* instead of on leaves as is its more usual habit. It is seldom seen along the beaches and it avoids the woods.

Seasons.—In the last half of May, more rarely early in May, a few ragged individuals appear which have emerged from hibernation. At the same time (my earliest record is May 4, 1930) small fresh males appear which have emerged from overwintering chrysalids. Fresh individuals, increasing in size, continue to appear, and by early June are often more numerous than the individuals which have hibernated. This butterfly, however, is always scarce in spring. In the last days of June, throughout July, and during the first three weeks in August the fresh examples of the summer brood appear; while always more numerous than spring specimens, these are never very common. Shortly before the first of September fresh butterflies again appear, and by the middle of the month have become common. They continue to emerge through warm periods in October and November, and I have a freshly emerged specimen that I found dead in Rock Creek Park with its wings still soft, in the middle of December, 1926. The adults of this brood hibernate, and together with them some of the chrysalids winter over, from which the butterflies emerge the following May or June, flying with ragged individuals that have passed the winter as adults.

Remarks.—This butterfly was very common in 1926, rather common in 1927, and very scarce in 1928, when only a very few were seen, never more than one in a day. In 1930 it appeared unusually early, shortly after the first of May, and spring individuals, especially freshly emerged individuals, were exceptionally common. At the end of the season, late in September and in the first half of October, the numbers were about the normal average.

The American painted lady seems to differ from its immediate relatives the painted lady (*Pyrameis cardui*) and the red admiral (*Pyrameis atalanta*) in occurring in only a single form.

PYRAMEIS CARDUI (Linnaeus)

PAINTED LADY

Plate 8, Figures 1 to 3

Occurrence.—Usually frequent or rather common, in some years abundant and in others very scarce, and often absent altogether.

The painted lady is ordinarily a butterfly of dry open fields, waste lands, and dusty roadsides, but in the years of its abundance it is to be found from about the middle of July onward throughout the open country and the drier woods, especially along the roads, in parks and gardens, and even about the streets in all sections of Washington.

There are two specimens from Washington in the National Museum, both taken on sunflower, one on August 8 and the other on August 14, 1888, and also one from College Park, Md., taken on August 6, 1914.

Notes.—In the District the individuals of this butterfly are found to differ more or less markedly from the specimens caught in the sterile and dry areas where it is always to be found. They are larger, brighter, and more pinkish above, and darker and more richly colored on the underside. Sometimes the last three submarginal black spots on the hind wings above have conspicuous blue centers (form *jacksoni*, pl. 8, figs. 2, 3).

These large and handsome individuals are less shy than the smaller and duller ones, and also less active. They spend much of their time feeding on flowers and when disturbed are very loath to leave a particular spot, simply circling about for a short distance and then returning. Early in the morning they sun themselves on leaves after the fashion of the fritillaries, but in the middle of the day they seem to avoid the hot and sterile areas where the small dull ones are frequent.

The large and brightly colored individuals probably represent the "wet" form of this butterfly, correlated with the development of the caterpillar on vegetation growing in damp regions.

About Washington I found them common in 1926 in the damp fields between Conduit Road and the canal 2 miles beyond Cabin John, where the shelters of the caterpillars were abundant on the thistles, and in 1927 I took a few at Silver Spring, where they occurred in and near a moist depression in open fields.

So far as I know this form of the butterfly does not survive the winter either here or in New England, as all the few individuals that I have seen in spring have been of the small dull form. Its appearance seems to be dependent on females of the normal form becoming dispersed over damp regions in the late spring.

Prof. C. V. Riley wrote that in 1884 this butterfly attracted considerable attention, "feeding upon nettles and thistles."

Habits.—The painted lady is very active, alert, and wary, with a powerful and rapid flight. Ordinarily the flight is very irregular and tortuous, with numerous twists, turns, doublings, and upward and downward darts, at an average height of about 6 feet above the ground. Over fields abounding in red clover, of which this butterfly is very fond, or over beach peas (*Lathyrus maritimus*), the flight becomes less irregular without the upward and downward dashes, and is only 2 or 3 feet above the ground, or from 6 inches to a foot above the grass tops.

When the painted lady is traveling from one region to another, the flight is direct and rapid, and the wings are flapped continuously and rather slowly. The height is usually from 10 to 15 feet above the ground, and the speed is between 20 and 25 miles an hour. This flight resembles the corresponding flight of *Vanessa antiopa* and of *Polygonia interrogationis.* Over the sea—at least in Massachusetts Bay—the same type of flight is maintained, but there the speed is less and the insect travels ordinarily 2 or 3 feet above the surface in calm weather. Like the monarch (*Danaus plexippus*) this butterfly, at least in a very light wind, travels in any direction, though always in a straight line, in contrast to the pierids, which, so far as I have seen, always travel against the wind.

When frightened the painted lady dashes diagonally upward, then turns abruptly to the left or right, circles about, and commonly returns to the place from which it started, alights, immediately turns its back to the sun, and spreads its wings. As it rises into the air it is very conspicuous, but on turning a second or so later it seems abruptly to disappear, owing to the presentation of the gray undersurface of the wings to the observer. If disturbed while feeding it quickly circles about and returns to the same or a neighboring plant, and on alighting spreads its wings. If badly frightened it rises to a height of 10 or 15 feet or more and makes off with great speed in a straight line.

It is fond of sunning itself on hot exposed rocks or on bare spots in roads with the head away from the sun and the wings spread out horizontally.

When this butterfly is feeding, the wings are usually closed above the back with the fore wings drawn somewhat forward, exposing the brilliant color of the undersurface, but from time to time the wings are suddenly opened and after a second or two closed again.

This butterfly usually hides away at night in short grass, as near the roots as possible, or in the interior of such low-spreading plants as beach peas; but it will hide also in hedges, or in almost any place that offers suitable concealment. When disturbed it flies out at once, so that in the great majority of specimens caught the wings are more or less cut or torn, although the damage is not usually extensive.

The painted lady is very fond of flowers, particularly of thistles and other composites, of the milkweed and buttonbush, the beach pea, and of the privet and other garden plants. It prefers flowers from 3 to 6 feet above the ground, though it is often to be seen on beach peas and on the red clover. When feeding on privet and milkweed it is, like other butterflies, especially easy to catch.

Seasons.—Ragged and faded individuals are seen in the last half of May and well into June. These are butterflies that have hibernated as adults. They are always few in numbers, at least in the District. About the middle of June fresh butterflies of the summer brood appear, and by the end of the month have become common. When the butterflies of this brood have become worn and faded and have greatly decreased in numbers, those of the autumn brood appear, beginning about the first of September. By the middle of September these have become common, and fresh butterflies continue to emerge until cold weather; that is, until late in October. So far as I know, fresh butterflies are never found here in spring, so that presumably winter is always passed in the adult form. But this can not be regarded as a determined fact, as this insect often passes the winter in Europe as a chrysalis, and in certain years it may do the same here.

Remarks.—The painted lady is undoubtedly the most generally familiar of all butterflies. It is found from the boreal or even subarctic regions southward to Ecuador, Peru, Venezuela, and Trinidad, though it is very rare in northern South America, throughout Europe and Africa, in Asia southward to the higher districts of India, and the high altitudes in the Malay Archipelago. In Australia and New Zealand it is replaced by a closely allied species (*Pyrameis kershawi*).

In some years in Washington its caterpillars are not uncommon on hollyhocks in gardens throughout the city.

The painted lady was abundant in 1926, when it was much more numerous than the American painted lady (*Pyrameis virginiensis*). In 1927 it was frequent, though scarcely common, and was outnumbered by its relative. In 1928, 1929, and 1930 it was, so far as I have been able to learn, wholly absent from this region.

I do not believe that this butterfly ever survives the winter within the boundaries of the District. Early in spring it is to be found only along the river, and in the small dull form. My impression is that the District is repopulated every year, or almost every year, by the progeny of overwintering females, which from somewhere nearer the sea wander up along the shores of the bay and of the river, and that these brightly colored individuals, the young of the overwintering females, scatter far afield. As this butterfly has a peculiar fondness for sea beaches and shores generally, such a procedure would be quite natural for it.

In July and the first half of August, 1924, this was the commonest butterfly in Essex County, Mass. It was most abundant in fields, in gardens, along the roadsides, along the beaches, and in the treeless areas near the shore. But it was also common in bogs deep in the woods and frequent in the woods themselves, especially along roads.

Genus VANESSA Fabricius

VANESSA ANTIOPA CRETA Verity

CAMBERWELL BEAUTY; MOURNING CLOAK

Plate 9, Figures 1, 2

Occurrence.—Frequent, though never very common, in deciduous woods, especially on hillsides and in the higher areas, and occasional in low open fields about willows.

The Camberwell beauty is most numerous in the higher and more open woods in Rock Creek Park, especially where pines are plentiful, and in the woods between Cabin John and Great Falls, Md. I have noticed it about willows in the moist portions of the fields between Conduit Road and the canal, and in similar localities at Silver Spring. It is occasionally seen about poplars and elms in the city of Washington, and I have found the caterpillar on elms in the Smithsonian Institution grounds.

There is a specimen from Washington in the National Museum collected by F. Burgess.

Habits.—This is the hardiest of our local butterflies, and a few warm days at any time during the winter will suffice to bring it out of hibernation.

Very early in spring it is the most conspicuous of the woodland species, and may be seen flying rather rapidly through the trees 5 or 6 feet above the ground in a more or less straight line, flapping a few times, then sailing, flapping again and sailing.

The females never fly very high unless engaged in laying their eggs, when they will rise to the tree tops, but the males may frequently be seen flying slowly along a road or path from 6 to 10 feet in the air, for the most part sailing, but occasionally flapping their wings.

In spring this butterfly is seldom seen except when it is traveling from one place to another through the woods in a very businesslike fashion. It is belligerent, but not especially aggressive, and by no means so given to play as it is in summer and early in autumn. Its main preoccupation is the preparation for the next brood.

In summer or on a warm day in autumn, it is very active and especially delights in playing about open spaces in the woods and along wood roads. It will perch on a log or on the road, or head down on a tree trunk, with its wings widely spread, dart off, circle rapidly and irregularly about, and return to the place from which it started. It is bold, pugnacious, and aggressive, and two on meeting will often rise battling to a height of 20 feet or more. In the open it will dart viciously at the larger dragonflies that venture too near the willows on which it rests, and it will also dart at the smaller birds, sending them to cover. The only other butterfly in our fauna that habitually attacks birds is the milkweed butterfly (*Danaus plexippus*), which cherishes violent animosity toward the hummingbird.

In crossing open fields this butterfly flies at a height of 6 to 10 feet above the ground and proceeds in a direct line with the wings continually in motion.

Like the milkweed butterfly (*Danaus plexippus*, pl. 6, fig. 4), this species is an expert at feigning death. On being removed from the net it will often lie for some minutes quietly on its side on one's hand with the wings closed above the back.

Another curious thing about it is its power of producing a faint grating or buzzing noise.

Seasons.—The Camberwell beauty appears with the first warm days of spring, and it may sometimes be seen as early as the latter part of February. Usually it is first found in numbers during the first warm spell in March, and it continues on the wing in undiminished numbers throughout April. In May its numbers decrease, and it disappears in the latter half of the month. In the District individuals are occasionally seen flying about sheltered places in the woods in December, January, and February. The butterflies of the summer brood first appear about the middle, or in the latter half, of June. I have a fresh specimen taken on August 19 that presumably belongs to this brood, so that emergence may take place over a period of two months. But there is a possibility of a partial intermediate brood here from eggs deposited very early by overwintering females. The autumn brood begins to appear very early in September, and the butterflies continue to emerge until late in October, flying until the approach of winter forces them into hibernation. It is possible that some of the late emergences represent young from a partial brood intermediate between the summer and regular autumn broods, but this remains to be determined.

Notes.—The National Museum contains a specimen of the aberration *hygiaea* taken in Washington by F. Burgess. The yellow border is extended inward over the area typically occupied by the blue spots. On the hind wings the yellow border, the inner edge of which is less strongly curved than the outer margin of the wings, occupies the outer third of the wings in its widest part. On the fore wings the yellow border is about half as wide as on the hind wings and is heavily dusted with brown.

Remarks.—This is a common butterfly everywhere in subarctic North America, Europe, and Asia, ranging southward to northern Florida and the highlands of Guatemala, northwestern Africa, the Himalayas, Amurland, and northern Japan. In some regions it is subject to great fluctuations in abundance from year to year, while in others, as in the District, it seems to vary but little in its numbers.

The typical form (*Vanessa antiopa antiopa*) is the small pale far-northern form with a narrow light border that occurs in subarctic and boreal regions everywhere and does not enter the United States. The form found in the District is *V. a. creta* Verity, which is found in central and southern Europe and which in America ranges from eastern Canada and New England southward to northern Florida and the highlands of Guatemala.

So far as I am aware the caterpillars of this butterfly have never been troublesome in the District, but in New England and elsewhere they are often so abundant as to disfigure and in some cases more or less completely defoliate ornamental trees, particularly willows and poplars but occasionally also elms. In California they sometimes defoliate rose bushes.

It was formerly commonly supposed that these caterpillars are poisonous, and so great was the fear of them that people would cut down all the poplar trees about their houses to prevent their appearance.

Genus POLYGONIA Hübner

POLYGONIA INTERROGATIONIS (Fabricius)

Question Mark

Plate 10, Figure 3

Occurrence.—Frequent, though not very common, throughout the District and surrounding country. It is most numerous in the open woods along the canal and Conduit Road from Cabin John to Great Falls.

The question mark frequents open deciduous woods, the borders of woodland roads, and fields and gardens in the vicinity of woods.

In the National Museum there is a specimen taken in Washington by A. M. Ballinger on September 13, 1912, and another taken at Rosslyn, Va., August 29, 1913, on elm.

Habits.—The flight of this butterfly is rapid and irregular, but when traveling over open country it flies high, from 6 to 10 feet or more above the ground, in a straight line with a continuous and rather slow flapping of the wings.

The question mark especially loves to play about open places in the woods and along the sides of woodland roads and the bushy or wooded borders of fields, pitching down upon a leaf, opening and closing its wings, darting away, and, after circling irregularly about, returning almost to the spot from which it started. Like all its relatives it is fond of basking in the sunlight with its wings outspread, usually on a leaf of a convenient bush, sometimes on a log or stone.

The females of the dark summer form have the curious habit of fluttering slowly about in the dark interior of bushes or thick groups of herbaceous plants after the fashion of *Argynnis cybele.*

Though it occurs everywhere with the hop merchant (*Polygonia comma*), it is much more often seen in open country than the latter, for it sometimes wanders widely over fields and grass lands. It is occasionally noticed about willow trees in meadows, and until a few years ago was not infrequent about elms in the parks and along the streets of Washington, particularly in the Smithsonian Institution grounds.

Its chief food plant in this region seems to be the hackberry (*Celtis occidentalis*), and I have found its pupae on elm in the

Smithsonian grounds. Its occasional presence in moist open fields in company with the red admiral (*Pyrameis atalanta*) has led me to search for its caterpillars on the false nettle (*Boehmeria*), though without success. Elsewhere it feeds upon this plant.

Seasons.—The question mark comes from its winter quarters toward the end of April and early in May, and the ragged spring individuals have all disappeared before the first of June. A second brood (of the form *umbrosa*) begins to appear in the first half of June. Early in August fresh individuals of the dark form are seen that probably represent a second summer brood. In the second week in September the first individuals of the light autumn brood appear, these continuing to emerge until well into October, when they go into hiberation.

In this region this butterfly appears to be partly two and partly three brooded. In New England, according to Mr. Scudder, it is two brooded, while in West Virginia, according to W. H. Edwards, it is partly three and partly four brooded.

Remarks.—The summer broods are made up almost exclusively of the dark form (*umbrosa*) in which the hind wings are almost entirely dark brown, the tails on the hind wings are relatively short, and the angle on the fore wings is only moderately produced. The autumn brood consists almost entirely of individuals of the light form (*fabricii*) with the hind wings but little darker than the fore wings, long tails, the angles of the fore wings greatly produced, and a conspicuous violet edging to the wings. But I have taken dwarf individuals of the dark form which have hibernated early in spring, and individuals of the light form in the last week in June.

Note.—Mr. Scudder said that the upper posterior lobe of the clasps in the male is slightly shorter and less produced, and the upper basal process is a little slenderer, in the dark form (*umbrosa*) than in the light form (*fabricii*). Carl Heinrich has recently studied the male genitalia in these two forms and found no differences.

POLYGONIA COMMA (Harris)

Hop Merchant

Plate 11, Figures 3, 4

Occurrence.—Frequent, though not very common, throughout the District and surrounding country. It is most numerous in the woods along the canal and Conduit Road to Great Falls, and is frequent in the higher and drier woods in Rock Creek Park. It is casual in the Smithsonian Institution grounds and about elm trees elsewhere in Washington, and I have found the pupae on the trunks of elms on the Constitution Avenue side of the New National Museum.

The hop merchant is especially a butterfly of open deciduous woods, where it is seen flying among the trees or playing about the clearings and along the roads, and from which it seldom wanders.

Habits.—The habits of this butterfly resemble those of the question mark (*P. interrogationis*), but it is more strictly confined to woods and is more active, wary, and alert, with a more pugnacious disposition.

Its flight is usually rapid and excessively irregular, and it is prone to dart viciously at other insects, including butterflies of other species. But it is sometimes seen flying leisurely through the woods at a height of 4 or 5 feet, at the rate of 10 to 12 miles an hour, zigzagging along, progressing by a series of quick flaps followed by a more or less extended glide, always keeping to the same general direction.

In sunning itself it prefers to rest on the bare ground of woodland roads, though, like the question mark, it is often seen on leaves, especially early in the morning and after rains.

If disturbed it will dash away with a precipitate and most irregular flight, sometimes rising above the treetops, sometimes circling about and alighting head down on the trunk of a near-by tree, then dashing off again, but often returning to the exact spot from which it started.

In open country, where it is seldom seen, this butterfly usually flies low, at the height of about a foot above the ground, traveling rapidly in an almost straight line, alternately flapping and sailing.

Like the Camberwell beauty, the hop merchant often feigns death, lying quietly on its side with the wings closed above the back.

Seasons.—With the first warm weather in spring the hop merchant emerges from hibernation and is to be seen coursing in a zigzag fashion through the woods. It appears on warm days in March and flies through April and into early May. These spring examples are almost exclusively worn individuals of the light form (*harrisii*), but I have a specimen of the dark form taken May 12, 1929. After the middle of June fresh butterflies appear, and these continue to emerge for about a month, or until after the middle of July. They are practically all of the dark form (*dryas*). From the first to nearly the middle of September more or less worn examples of the dark form (*dryas*) are found with fresh examples of the light form (*harrisii*). I interpret the dark specimens as representatives of a brood appearing about the middle of August and originating from eggs laid by the earlier individuals of the summer brood; in other words, a supplementary brood, the eggs from which will, if the season be sufficiently delayed, produce butterflies of the light form in October. The light individuals, which represent the hibernating form, are probably from eggs laid by the late individuals of the early summer brood.

Remarks.—The dark summer (*dryas*) and light autumn (*harrisii*, pl. 11, fig. 3) forms of this insect differ in the same way as the corresponding forms of the question mark (*P. interrogationis*), but the differences are not so strongly marked. The dark form occasionally is found early in spring, and the light form is sometimes seen early in summer when only the dark form should occur.

W. H. Edwards found that this species is three brooded in West Virginia. The first brood is composed of the dark form (*dryas*) only, the second of both the light and the dark forms, and the third of the light form (*harrisii*) only. About Boston it is double brooded, the individuals of the summer brood being almost, though not quite, exclusively of the dark form (*dryas*), while those of the autumn brood are almost without exception of the light form (*harrisii*). In this region conditions seem to be intermediate between those in Boston and those in West Virginia, but the subject is one for further investigation.

The Schönborn collection contains four specimens of the light (*harrisii*) form, one dated September 16 and one October 16, the others undated. The National Museum contains two specimens of this species from Washington, D. C., one, dated June 1, 1911, bred from hop by Dr. W. W. Stockberger, and the other, dated June 5, 1900, bred from thistle.

POLYGONIA PROGNE (Cramer)

GRAY COMMA

Plate 11, Figures 1, 2

In the Schönborn collection there are four specimens about a label reading "*Grapta progne* (Cramer), Washington, D. C." Of the four specimens two are from New York, one is from Nebraska, and one has no label and is presumably from Washington.

There is no further indication of its presence in the District, but its occurrence as a rare or temporary resident or as a casual is to be expected, as it occurs southward as far as western North Carolina.

Genus PHYCIODES Hübner

PHYCIODES THAROS (Drury)

PEARL CRESCENT

Plate 7, Figures 7, 8; Plate 13, Figure 5; Plate 19, Figure 3

Occurrence.—Abundant throughout the District and the surrounding country, being, in fact, the commonest butterfly of the region;

it abounds in all open areas and is especially numerous in neglected and weedy fields with an abundance of asters.

There is a specimen in the National Museum collection taken by Dr. F. H. Chittenden in Washington on September 30, 1915.

Habits.—The flight of the pearl crescent is rather rapid for such a small butterfly. It maintains a uniform height of from 4 to 6 inches above the grass tops, and as it travels along, alternately flapping and sailing, it dodges from side to side so that it is rather difficult to follow with the eye. Its usual rate of progress is about 5 miles an hour in a straight line. As a rule its flights are not very long, though sometimes it may be followed for 100 yards or more without showing any signs of tiring.

When sunning itself on a leaf or grass blade, which it is very fond of doing, it holds its wings extended horizontally and from time to time waves them rather slowly up and down for a few seconds, each pair of wings moving through an arc of about 45°, then again spreads them out to the horizontal. The head is usually directed away from the sun.

If startled this butterfly usually rushes away with a rapid dodging flight after the manner of the fritillaries. If much frightened it dashes off in a perfectly straight line.

When mated pairs are disturbed, the female flies away carrying the male.

The males are much more active than the females and have a more rapid and more irregular flight. They are fond of haunting roads, resting on stones or on the bare ground or sucking moisture from mud. They are usually seen on mud as individuals, scattered here and there, but when abundant they often gather into little groups of from three to a dozen or more. In the same way two or three or even as many as half a dozen may be seen on a particularly attractive rounded stone.

They are pugnacious and aggressive. They will dart viciously at the larger grasshoppers, at flies and bees, and also at the larger butterflies, particularly brown ones, seeming to have a special enmity for the viceroy (*Basilarchia archippus*) and the milkweed butterfly (*Danaus plexippus*). The former can escape from them without much difficulty, but they cause the latter much annoyance. A milkweed butterfly pursued by a pearl crescent dodges clumsily this way and that, acting much like a crow tormented by a hummingbird.

There is a constant feud between the males of this butterfly and those of the buckeye (*Junonia lavinia*). A buckeye will often dart at a pearl crescent; but almost invariably the latter turns the tables on it and it is glad to make its escape.

The least skipper (*Ancyloxypha numitor*) seems to be the only butterfly able invariably to vanquish the pearl crescent. As a rule this is a very peaceful little butterfly, but if a pearl crescent flies near the grassy patch that it regards as its home territory, it will at once dart at it, and the pearl crescent always retreats as rapidly as possible.

Bumblebees and carpenter bees seem to dislike this little butterfly and will leave a flower when it approaches; but wasps pay no attention to it. Although it is so very common, I have never known it to be attacked by a crab spider, by a phymatid bug, or by an ant.

The reason for the very marked dislike shown by many other insects for this butterfly is difficult to understand. It may be that it possesses a repellent odor, imperceptible to us, for other insects certainly avoid it in much the same manner as mammals do a skunk.

The pearl crescent is very fond of flowers, especially of the orange flowers of the butterflyweed (*Asclepias tuberosa*), on which it may sometimes be seen by dozens even when it does not appear to be common in the immediate vicinity. It is also extremely fond of the flowers of the button-snakeroot (*Eryngium yuccaefolium*). As a rule it prefers flowers at about the level of the grass tops and is perhaps most frequently noticed on the flowers of the smaller asters and of *Eupatorium coelestinum*, although it never congregates on these as it does on the flowers of the butterflyweed and of the snakeroot.

Seasons.—The pearl crescent appears early in spring, at the end of the first week in April, simultaneously with the tailed blue (*Everes comyntas*) and about a week later than the common blue (*Lycaenopsis argiolus pseudargiolus*). Though individuals are sometimes seen as early as the first week in April, this butterfly usually first appears about the middle of that month, and by the first of May has become common; it disappears early in June. The individuals of the spring brood are never very numerous. Those of the second brood appear in small numbers just after the middle of June, becoming numerous by the first of July, and fresh ones are common throughout July and into August. Toward the end of August fresh individuals again appear and increase in numbers, becoming abundant after the middle of September and continuing to appear until the middle of October.

There are probably three broods in this region, but the butterfly is common throughout the summer, and fresh individuals are almost always to be found. It is least common in the last half of June.

Remarks.—At Essex, Mass., I once so frightened a pearl crescent that it made off in a straight line, rising gradually as it went. It had not gone many feet before it was seized by a dragonfly, which immediately settled on a leaf and was captured. The butterfly was found to be without a head and quite dead.

Notes.—In a specimen taken at Cabin John on July 25, 1926, the cell of the left hind wing has been eliminated through the very close approximation of the bordering veins (pl. 19, fig. 3). This is accompanied by an alteration of the color pattern on both surfaces. On the upper surface the black line which crosses the wing parallel to the outer margin just within the submarginal row of black spots is lacking, and the black spots, which are more or less elongated inwardly, have moved to its position with a corresponding inward extension of the markings between these spots and the outer margin. On the underside the row of whitish spots that crosses the middle of the wing parallel to the outer margin is omitted, except for the single large spot on the anterior margin, and the other markings are correspondingly extended basalward.

A male with the black markings above fused (pl. 7, fig. 8) was taken at Silver Spring on July 7, 1928.

PHYCIODES BATESII (Reakirt)

Bates's Pearl Crescent

Plate 13, Figures 3, 4

Occurrence.—Rare. I have two specimens, both from Cabin John, taken on May 17, 1925, and June 16, 1929.

Remarks.—This species seems not to differ in habits from *P. tharos.*

Genus EUPHYDRYAS Scudder

EUPHYDRYAS PHAËTON PHAËTON (Drury)

Balmony, or Turtlehead, Butterfly

Plate 11, Figures 7, 8

Occurrence.—Very local; found in the swamps along the Eastern Branch (Ernest Shoemaker) and in the swamps along the road from the southern end of the Highway Bridge to Arlington, Va. (William Schaus), as well as in the damp meadows between Conduit Road and the canal 2 miles beyond Cabin John, Md., wherever the food plant (*Chelone glabra*) is common. In the restricted localities wherein it occurs it is always abundant.

Habits.—There is a great difference in the habits of the two sexes of this butterfly, and apparently considerable diversity between different individuals of the same sex. The smaller females are much more active than the larger ones, and the larger males are less active than the smaller. The large females I have never seen more than about 20 feet from the food plant, but the smaller females occur throughout the range of the males.

Both sexes seem to shun the food plant, and the only individuals I have seen on, or even very near it, were large females engaged in depositing their eggs.

But while the butterflies show a strong distaste for this plant, preferring to rest on almost any other, they never voluntarily wander very far from it. They are most common in the grass from 10 to 20 feet from the patches of turtlehead, and the males and smaller females are frequent up to about 150 feet away.

In cloudy weather and on cool days the butterflies are very reluctant to take wing. But on bright, hot days the males, especially the smaller ones, are very active. They fly rather swiftly for their size, with rather rapid wing beats and occasional glides, after the fashion of *Euptoieta claudia.* Usually they keep near the grass tops, but occasionally they will dart rapidly upward in an erratic zigzag to a height of sometimes as much as 10 or 15 feet, soon coming down again and perching on a grass blade. They will often go for a long distance without alighting, sometimes even out of sight. On a hot and sunny day these small males when they take wing are by no means easy butterflies to catch, though when resting they are singularly unsuspicious.

The large females always are inert and when startled usually fly only a yard or two, and seldom as much as 20 feet. They fly only a few inches above the grass tops, with a weak and tremulous flight. When resting they are wholly unsuspicious. Once seen, either on the wing or resting, they can invariably be caught.

A captured female taken in the hand will sometimes feign death, lying motionless on its side for several minutes.

Season.—The turtlehead butterfly is on the wing from about the end of the first week in June, or in some years the last of May, to about the middle of July. My earliest and latest dates are May 30 and July 11.

Up to 1930 my earliest date was June 11, but in that year I secured three on May 30. The spring of 1930 was very cool and dry, and the absence of hot spells probably accounted for the early appearance of this butterfly.

Remarks.—The most practicable way of finding the places inhabited by this butterfly is to search for the food plant, the common turtlehead (*Chelone glabra*)—which is very easily recognized at all seasons—toward the end of July when the large silk webs made by the gregarious caterpillars are very conspicuous on the summits of the stalks. A visit to the localities where these webs are found in the middle of the following June will disclose the butterflies in abundance, and also yield numbers of the conspicuous fully grown black and orange caterpillars from which perfect specimens of the butterflies are easily raised. The caterpillars will be found not upon the turtlehead, which at that time is only a few inches in height, but resting on the grasses, cattails, and other plants, and especially upon the dead stalks of herbaceous plants.

When about to molt for the last time the caterpillars usually crawl to the top of the highest available dead cattail or other herbaceous plant, where they often gather in considerable numbers. After the molt they scatter, and they then appear to be much less abundant, for at any given time most of them will be feeding or will be on or near the ground searching for the food plant.

In the chief locality for this insect at Cabin John it was very abundant in 1926. But in that year the main patch of turtlehead was mowed down during the summer. In the following spring, when I visited the locality in company with Dr. Karl Jordan, there was no trace of the insect where previously it had been abundant, though a few of the caterpillars were found on some small groups of turtlehead some distance away. In 1927 extensive and continued search of the whole area, on one day in company with Irvin N. Hoffman, failed to reveal any trace of caterpillars or of adults, and neither caterpillars nor adults were to be found in 1929. In 1930, however, the caterpillars reappeared in numbers on the main patch of turtlehead, though they were not found on the small groups or on the scattered plants.

As the search of this area in 1928 and 1929 had been very thorough, it is probable that the insect had been reintroduced in the summer of 1929 and had not simply escaped detection in the two seasons in which it was not found. This explanation of its reappearance receives added weight from the fact that in 1930 only a single caterpillar parasitized by *Apanteles euphydryadis* was found, whereas the normal amount of parasitization by this species here is about 18 per cent.

Genus BRENTHIS Hübner

BRENTHIS MYRINA (Cramer)

SILVERED BOG FRITILLARY; MYRINA

Plate 3, Figures 5 to 7; Plate 4, Figure 5

Occurrence.—I have found this butterfly only in the boggy pasture on the south side of the road from the Beltsville, Md., railroad station to the experiment farm of the Bureau of Animal Industry, Department of Agriculture, where it is rather common. At the height of the season, in the middle of July, 8 or 10 may be caught in the course of an afternoon.

Season.—This species first appears in the last days of June or just after the first of July and becomes increasingly common until the middle of July, when worn individuals preponderate, although fresh ones are still to be found. My earliest record is a perfectly fresh specimen taken on June 29, 1929. As the afternoon of June 22 had been spent in carefully searching the bog without result, the insect must have made its first appearance very shortly before, if not actually on, the date of capture. On July 4, 1929, two were seen, but were not caught. On July 13, 1929, eight were caught in the course of the afternoon, about half of them much worn. On July 17 the bog was visited in company with Dr. G. W. Rawson, of Detroit, Mich., and five were caught and two more seen in the course of half an hour. The first specimen captured was taken July 15, 1928, by the side of the road, but in that year the curiously restricted area in which alone this butterfly is found was not searched.

In the vicinity of Boston, Mass., this insect usually first appears in the early part of the last week of May, and it becomes abundant early in June. Mr. Lintner reported it as abundant at Albany, N. Y., on May 16, and Mr. Scudder took it there on May 17. It is reported from Ottawa, Ontario, on May 22.

In New England there is a second brood which appears in the last week in July, and as early as the first week in July in Nantucket. The butterflies of this brood are on the wing before those of the first brood have disappeared. They continue to emerge through a part of August, and, according to Mr. Scudder, are found on the wing in September, when the individuals of the third brood have made their appearance.

The silvered bog fritillary thus first appears in the vicinity of the District a full month later than it does in the vicinity of Boston and of Ottawa, and nearly six weeks later than at Albany. Still more interesting is the fact that in this vicinity there is only a single brood instead of the three broods found in New England.

The region where it occurs locally is subject to flooding in spring with the presumable frequent submergence of the caterpillar, which may account for the late appearance. Late in summer the locality becomes very dry, so that probably the caterpillars estivate, estivation and intermittent feeding being followed by hibernation. This would prevent the appearance of any but early and midsummer imagos and eliminate late-summer and autumn broods.

The three other butterflies especially characteristic of the area where the silvered bog fritillary occurs (*Satyrodes eurydice*, *Atrytone pontiac*, and *Poanes massasoit*) are similarly single brooded.

Remarks.—This is not a very conspicuous insect, and unless one is especially on the watch for it it is likely to escape notice. It is very easily mistaken for a yellow dragonfly, just as *Euphydryas phaëton* is easily mistaken for a black-winged dragonfly.

Its flight is direct and rather fast for such a small butterfly, most nearly resembling that of *Euptoieta claudia*, but less nervous. It progresses by a series of flaps alternating with glides at the rate of 5 or 6 miles an hour, maintaining a uniform height of from 2 to 6, usually about 4, inches above the grass tops. It is noticeably swifter than the smaller form found about Boston, which flies at the rate of between 4 and 5 miles an hour.

It is very unsuspicious, and if feeding on a flower may always be captured with the greatest ease. It will sometimes alight on a flower within a few inches of the collector. If frightened when on the wing, as by the close passage of a net, it usually closes the wings over the back and drops into the grass, where it conceals itself, often quite effectively. More rarely it makes off with increased speed in a zigzag flight, but without rising above the usual height. This last peculiarity is probably due to its fear of dragonflies, which infest its habitat in great numbers. Their plane of flight is higher than that of the bog fritillaries, and although they quickly seize any unlucky butterfly that rises to their level they will not pounce on anything below them.

Notes.—The specimens from Beltsville (pl. 3, figs. 5, 6; pl. 4, fig. 5) are noticeably larger than specimens from the vicinity of Boston (pl. 3, fig. 7). A series of 16 from Beltsville have the fore wings from 22 mm. to 25 mm. in length, averaging 23.75 mm. A series of 19 taken at Dedham, Mass., on August 28, 1930, have the fore wings from 18 mm. to 23 mm. long, averaging 20.3 mm. Mr. Scudder gives the length of the fore wings in this species as from 17.5 mm. to 21.5 mm., and the average as 20.6 mm.

The ground color above is usually about the same as in the darkest northern individuals, but in some it is darker and more reddish than in any from the north. The black markings are always somewhat broader and heavier than in northern examples, and are often much heavier so that they are more or less extensively confluent. On the undersurface of the wings the color varies from about as dark as in the darkest northern specimens to very appreciably richer. The black markings on the underside of the fore wings are always heavier than in northern examples.

Genus ARGYNNIS Fabricius

ARGYNNIS IDALIA (Drury)

Regal Fritillary

Plate 13, Figures 1, 2; Plate 14, Figure 1

Occurrence.—Common, but locally distributed, the males ranging more widely than the females. This species is numerous in the fields between Conduit Road and the canal beyond Cabin John and in the damp hollows in the fields across Blair Road from the Hyslop estate at Silver Spring, Md., frequent on the flats below Chain Bridge, along the Eastern Branch, and in the bogs at Beltsville, and infrequent or casual elsewhere. Wandering males are occasionally noticed everywhere in open country. I saw a male in the Smithsonian Institution grounds on July 12, 1928, another on Seventh Street near the Patent Office on August 15, 1928, and one at Fifteenth and U Streets NW., on July 12, 1930. Ernest Shoemaker has specimens from Black Pond, Fairfax County, Va.

The regal fritillary is a butterfly of open grassy fields with boggy hollows drained by small streams that are not bordered, or at least not completely obscured, by trees or bushes. It is a butterfly of the open country and will not enter woods, nor ordinarily even go near a tree. The females are found only in the general vicinity of marshy spots, but the males wander widely.

Habits.—The regal fritillary prefers more open and drier regions than the other larger local fritillaries, and where it is most common these are scarce. The males are often to be seen traveling over pastures where the others are never found. The females are very reluctant to leave that portion of a pasture representing home, and probably most individuals, though more or less constantly on the wing, do not wander more than a few hundred yards from the place where they were raised. The dispersal of the females is along the banks of streams or about boggy lowlands, and they are never seen far from running water until early in autumn, when they scatter more or less widely during the deposition of their eggs.

The flight of the regal fritillary is rapid and direct; the wing beats are less rapid than are those of the other larger fritillaries, and it glides more frequently and for longer distances. It usually flies 2 or 3 feet above the grass tops, or from 3 to 5 feet above the ground.

As was noticed by Mr. Scudder, the flight of the female is much less vigorous and sustained than that of the male. The females seldom fly higher than a foot or two above the grass tops, and never fly far, suddenly dropping into the grass after traversing from 50 to 100 feet, their flight being more rapid and longer on hot and sunny than on cool and cloudy days.

Although usually keeping near the ground, this butterfly will sometimes fly very high. I have seen a female pursued by two males rise to a height of at least 100 feet.

After about the first week of September the females become more active and tend to wander more or less extensively over grassy areas. They fly more strongly and swiftly than before, at a height of 4 or 5 feet above the ground. Every 100 feet or so they suddenly drop into the grass, where they walk about depositing their eggs. After a lapse of 10 or 15 minutes they are up and off again, usually continuing in the same general direction unless turned by woods or by a tree.

Though I have never seen *Argynnis cybele* engaged in depositing eggs except where violets are abundant, the female of the regal fritillary seems to deposit its eggs with mechanical precision on various plants, quite regardless of the presence of violets. This, combined with the fact that violets are not abundant in its usual haunts, leads me to believe that in this region it lives largely, or perhaps chiefly, on other plants, though what these are I do not know.

The regal fritillary spends the night concealed in the grass on or very near the ground. Alighting on the upper portion of a grass blade, it closes its wings and draws the fore wings back between the hind wings. Almost immediately it climbs slowly down to a position near the roots of the grass and turns head upward, or walks away a few inches on the ground. In either of these positions it is extremely difficult to detect against the dark earth, and the conspicuous silver spots give no indication of its presence, for they seem to be simply glistening drops of dew. In the morning the butterfly leaves its resting place by flying upward, in this way rubbing the long hairs from the dorsal surface of the thorax, wearing patches of scales from the upper surface of the wings, and often slitting the hind wings.

Early in the morning and after showers this butterfly is fond of sunning itself on the tops of grass blades with the wings spread horizontally and at right angles to the sun's rays and the fore wings drawn back and largely covering the hind wings. The other larger fritillaries (*Argynnis cybele* and *A. aphrodite*) prefer to sun themselves on the leaves of bushes or on the ends of the lower branches of a tree.

The regal fritillary is very fond of flowers, especially of the milkweeds and later of the thistles. It is most frequently seen on the flowers of the red milkweed (*Asclepias incarnata*), and I have noticed no less than four at one time on a single small plant of this species. It visits only tall, isolated plants, and on these prefers the topmost flowers from which the view is uninterrupted. This seems to be the reason why it frequents the red milkweed rather than the common species (*Asclepias syriaca*), which usually grows in groups and on which the flowers are some distance below the summit. On the red milkweed I have several times observed this species on the topmost flowers and *Argynnis cybele* on the lower flowers.

When frightened the regal fritillary usually makes off in a perfectly straight ascending line with continuous and powerful wing beats, always keeping in the open and avoiding woods and trees. But it will frequently fly for from 20 to 50 feet and then suddenly drop into the grass and hide. Sometimes if a net be waved at one passing by, it will drop into the grass and is then more or less easily caught.

This species is always shy and suspicious, and the males are more wary than the females. It is not readily attracted by bait or by decoys and, therefore, with the sole exception of the goggle eye (*Cercyonis alope*), it is the most difficult of all the local butterflies to capture in quantities.

This butterfly first mates immediately upon the appearance of the females about the first of July, and mated pairs may be found in which the male is rubbed and worn but the female is only a few hours old with the wings still soft and brilliantly iridescent. In such pairs the female will be found feeding on flowers, flying from one plant to another in the usual way carrying the male. Mating does not become general, however, until much later, and mated pairs are most frequently observed in the last half of August. Unless the female has very recently emerged, she does not feed while mating.

The courting of the regal fritillary is very different from that of *Argynnis cybele.* A female pursued by a male drops down onto the summit of a plant that rises well above the grass tops. The male follows and flutters actively all about her, below, above, in front, and on both sides, changing his position with great rapidity. The female, with the wings folded above the back, constantly flutters them very slightly and from time to time shifts her position in a nervous manner.

Mating occurs in damp, open grassy areas, not on the borders of woody and grassy regions as in the case of *Argynnis cybele.*

Clement W. Baker writes me that at Waynesburg, Ohio, he noticed particularly that unless the females of this species visit the flowers of alfalfa they were nearly all found on red clover. In visiting the clover they would invariably seek a cluster of flowers that were in a measure screened by other higher-growing plants. Also in the alfalfa fields they would be found resting not on the more exposed flowers, but rather on those near the bottom of the plants. So all the specimens that he secured in the open were either flushed in walking through the fields, or were watched as they alighted and their position thus determined. He found no females on milkweed, and not until later in the season on thistles.

Mr. Baker found that in many instances the females showed a tendency to drift into territory that had an abundance of fine swamp grass. Perhaps 80 per cent of all the females that he took were captured about the hour when the sun was sinking below the horizon. At this hour he was able to secure fine fresh specimens easily and without much exertion. When they were disturbed they would mostly rise up, fly a short distance, and settle again. Quite a few were captured as they attempted to rise. As darkness came on they would become lethargic and could then be taken without any exertion whatever.

At Waynesburg Mr. Baker found that in 1930 this species first appeared on June 21.

Season.—The regal fritillary first appears after the other large fritillary (*Argynnis cybele*) has become common. The earliest individuals, which are males, are on the wing about the middle of June. Their number slowly increases, and females begin to appear about the first of July. About the middle of July the males have all, or nearly all, emerged, but the females continue to increase in numbers until about the middle of August. At this time the males, though still abundant, are all more or less rubbed and worn. They remain common, however, throughout August and are seen in diminishing numbers until about the last week in September, when they entirely disappear. Toward the middle of September the females become more active than they have been previously, cease feeding on flowers, or at least feed very much less than before, and devote themselves to depositing their eggs. They may be seen thus occupied, in diminishing numbers, until at least the middle of October.

The regal fritillary seems to differ from the other two large species in this region (*Argynnis cybele* and *A. aphrodite*) in that the butterflies emerge continually from their first appearance until the end of the season, and there is no difference between the earlier and later individuals.

Remarks.—Compared with specimens from Essex, Essex County, Mass., specimens from the District are larger, the smallest of the latter being larger than the largest of the former. The increase in size is more marked in the females than in the males, the average length of the fore wing being 3 mm. more in District than in Essex County males, while the difference in the females from the two localities amounts to 5 mm. The difference in the average length of the fore wing between males and females from Essex County is 8 per cent of the average wing length of the males, while in the District this difference is 12 per cent of the average wing length of the males. Measurements of specimens from the two localities are as follows:

LENGTH OF FORE WING OF ARGYNNIS IDALIA

MALES: Essex County, Mass. (6) 36–40 mm., averaging 38 mm.; District of Columbia (5) 39–42 mm., averaging 41 mm.

FEMALES: Essex County, Mass. (3) 42–44 mm., averaging 43 mm.; District of Columbia (16) 46–50 mm., averaging 48 mm.

In color the District males are usually brighter than the northern males, but in the females the difference is imperceptible. In both sexes the black markings tend to be slightly heavier in northern examples, and the dark color near the inner border of the hind wings on the underside especially is more extensive.

In both northern and southern males the outer row of spots on the hind wings may become mixed with white scales, the lowest two or three sometimes being quite white. This is commonly correlated with a whitening of the ground color within the submarginal chevrons on the fore wings from the apex downward.

ARGYNNIS CYBELE CYBELE (Fabricius)

CYBELE

Plate 15, Figures 1, 2

Occurrence.—Common in wet meadows and along the marshy banks of streams and numerous throughout wet woodlands, where it is often seen along the roads and streams and in the more open areas. Except as a straggler it does not occur in dry open fields or in dry woods. Where an open field is traversed by a brook with marshy or wooded banks it is usually to be found in its immediate vicinity, but not elsewhere.

Habits.—The flight of this butterfly is rather rapid, being usually at the rate of about 15 miles an hour. It travels at a constant level at a height of 4 or 5 feet above the ground with continuous and fairly rapid wing beats, zigzagging from side to side, the angles of the zigzag being obtuse. The flight of the females is less rapid, less irregular, and less prolonged than that of the males, but the differences are very slight, and the sexes can not with certainty be distinguished on the wing, the larger males flying much like the smaller females. Up to the middle of August the females are chiefly interested in feeding; after that time they become more active and wander widely.

As a rule this butterfly will turn aside on meeting rising ground or reaching a patch of woodland, preferring to keep to low open country, but often it will keep directly on among the trees. When in the woods it is most frequent in the more open areas and along the roadsides, where its actions are very similar to those of the vanessids and other woodland butterflies. But it is not infrequently seen fluttering about with a more or less hovering flight, usually near the ground, in the interior of dense thickets.

The cybele is fond of sunning itself on convenient leaves of bushes or of the lower branches of trees, or sometimes on grass blades, and in the woods on the bare ground. During this performance the head is always directed upward and the wings are expanded to the horizontal with the fore wings drawn back so that their lower borders make an obtuse angle with each other.

When frightened it either dashes away at once or shows nervousness by a slight quick elevation of the wings. If on a leaf or in the road, it almost invariably flies off to the right or left, but if on a grass blade it may fly straight ahead. A frightened cybele on reaching a wooded area usually flies directly in among the trees, not turning to one side as does the regal fritillary.

The cybele spends the night either in grassy areas on or very near the ground, or in the interior of bramble thickets or similar situations. I have watched it alight on the upper portion of a grass blade, slowly crawl down almost to the ground, and then turn head up prepared to spend the night. In such a position it is almost invisible, as the dull colors of the under surface merge with the background and the conspicuous silver spots appear like drops of dew. I have also watched an individual crawl slowly for more than a yard into a tangled mass of brambles seeking a place in which to spend the night.

In the morning the insect flies out from its hiding place, to the detriment of the hairy covering of the thorax and the delicate scales on the upper surface of the wings. The wings themselves, especially the hind wings, are often more or less extensively slit and torn.

The habit of crawling into close quarters is very characteristic of this butterfly. Early in spring it is very fond of the flowers of the wild coffee (*Triosteum perfoliatum*), and in order to reach these it must search them out in a mass of foliage. When feeding on the flowers of this plant it is so completely hidden that its presence is unsuspected.

Later in the season it is very fond of the flowers of the milkweed (*Asclepias syriaca*). It will feed on the lower flowers as readily as on the upper, and on the flowers in the interior of a patch as well as on those on the exterior. It is the only one of our local butterflies that will feed on flowers with leaves above and on all sides as well.

It is equally fond of the flowers of the red milkweed (*Asclepias incarnata*), which always grow singly in the open. Here it feeds equally on the upper and the lower flowers. It is often seen on the flowers of buttonbush (*Cephalanthus occidentalis*) and of red clover, and late in the season sometimes on thistles.

I have twice watched the courting process of this butterfly. In both cases the female was seated on the horizontal upper surface of an alder leaf with the wings folded above the back and the fore wings drawn down to the maximum. On the same leaf an inch or so behind the female was a male with his body just in line with hers, and facing the same way. His wings also were closed above the back, but the fore wings were drawn forward so that their hinder border approached the vertical as that of hers did the horizontal. At intervals he would suddenly open and close his wings, these intervals, at first of about a second, gradually becoming less and less, and constantly, almost incessantly, he slightly shifted his position in a series of little rapid jerks.

In Massachusetts I have found this species paired in the second week in July, always in the shade of trees on the border of grass land.

In the District this species mates from early in July, or even earlier, until at least the end of the first week in September, my latest date for a mated pair being September 7, 1931. I have found mated pairs only along the borders of woods.

In the latter half of August the habits of the females undergo a decided change. They are no longer interested to any extent in flowers, and hence appear to have become scarce. They are to be seen singly coursing over meadows and pastures with a direct flight 4 or 5 feet above the ground hunting for violets. When a patch is discovered they descend fluttering into the grass and walk about examining the plants and from time to time depositing an egg. If there are many violets they may walk about for at least half an hour, covering 20 feet or more before they again fly up. Where violets are few the butterfly may simply hover for a few seconds a foot or so above them and then resume her flight.

Whereas the female of the regal fritillary will drop into the grass anywhere, the female cybele appears never to descend unless she has detected violets. I have several times watched a female regal fritillary wandering about, weaving in and out among the grass stalks, in places where violets were wholly absent, but I never saw a female cybele so engaged unless violets were numerous and conspicuous.

Season.—The cybele first appears, in small numbers, usually toward the end of May, but in cool years it is first seen during the third week in May. By the middle of June, or in cool years by the first of June, the males have become common and females appear. The females do not become common, however, until toward the first of July. After about the middle of August the males are all more or less worn and ragged, and by the first of September most of them have disappeared. But fresh females appear throughout August and may be seen even in early September on the flowers of the thistles. During September the number of females gradually diminishes, but they continue on the wing until after the middle of October.

Remarks.—The females of the form of this butterfly found in the District are unusually large, and most of them are very richly colored although pale females are not rare. In Essex, Mass., I have noticed that large richly colored females comparable to those occurring in the District, though scarcely so large, are found only among the latest to emerge. Farther north, in Maine and in the mountains of New Hampshire, the large dark form of the female seems never to occur.

Most of the males resemble the males of the northern form, except for being somewhat larger and having the ground color above somewhat richer. But many males are much darker, with the black markings above broadened and often blurred and the underside of the hind wings more or less strongly washed with cinnamon. These dark males appear with, or only a few days after, the males of the usual type.

The summer of 1931 offered especially favorable conditions for a study of this butterfly. The earliest individuals of both sexes were light in color both above and below, and were very much alike. In June, larger and much darker individuals appeared, the females especially being exceedingly dark with the hind wings relatively longer than in the earlier ones and having a suggestion of a broadly rounded angle in the lower third of the outer margin, and noticeably larger than the males. These large and richly colored individuals were abundant in July, occurring—in some localities, at least—almost or quite to the exclusion of the pale form. But in August they gradually disappeared, being replaced by individuals rather paler both above and below than the earliest individuals, quite uniform in color, with the two sexes of the same color and of approximately the same size. These remained common until the end of the season. This is probably the regular seasonal sequence of forms of this region.

ARGYNNIS APHRODITE APHRODITE (Fabricius)

APHRODITE

Plate 16, Figures 1, 2; Plate 17, Figures 1, 2; Plate 18, Figures 1, 2; Plate 19, Figures 1, 2; Plate 20, Figures 1, 2

Occurrence.—Rare; I took a single fresh but damaged female on August 10, 1927, near the wooded banks of the small stream through the pasture across Blair Road from the Hyslop estate at Silver Spring, and met with two males, one on July 4 and the other on July 7, 1928, in the same place. On July 4, 1930, I captured a female in the bog at Beltsville, and also a male in a pasture at the edge of the woods along Paint Branch. On June 20, 1931, I took a male at Cabin John. William Schaus tells me he has found it in this region.

Season.—Apparently this species here, as in New England, does not emerge until about the first of July, from which date it is to be found until the end of the summer. Its first appearance contemporaneously with *Brenthis myrina* and four or five weeks later than the first appearance of *A. cybele* is noteworthy. Farther south in the mountains of North Carolina, where it is locally abundant, it also is first on the wing about the first of July, while *A. cybele*, as in this region, appears toward the end of May.

Habits.—This butterfly has a somewhat more erratic and more nervous flight than *A. cybele*, and the two are easily distinguished on the wing. In fact the female taken at Beltsville was identified as *aphrodite* more than 100 feet away, which led to its capture some minutes later.

In all its actions *A. aphrodite* is more nervous and quicker than *A. cybele*, but it is easier to catch, as it is less shy and does not dodge into bramble thickets or thick undergrowth or drop into the grass. It keeps always to the open, not entering thick woods or fluttering about in the interior of thickets as *A. cybele* is so fond of doing.

It inhabits cool, grassy bogs on hillsides or in hilly or mountainous country, and seldom strays far from its particular bog, in which it is always abundant. It is much less of a wanderer than *A. cybele.*

Toward the last of August in eastern Massachusetts all the males of this butterfly have disappeared, and the only individuals to be seen are worn females laying their eggs. Flying about 4 or 5 feet above the ground in their usual rapid and irregular manner, from time to time they rather suddenly drop and crawl down into the grass where, completely hidden from view, they walk about searching for suitable violet leaves on which to place their eggs. But they are always alert and are quick to jump into the air if approached too closely.

This butterfly spends the night as far down as possible among the grass stems, or close to the ground in the interior of thickets, especially blackberry or bramble thickets. It takes great care in the selection of a suitable spot, and will sometimes crawl for 4 or 5 feet over the rubbish on the ground before it finds a hiding place to its liking. If disturbed it takes wing at once no matter where it is, and the rents so very common in the wings of this species are due to grass cuts and other damage resulting from a too hasty departure from a snug hiding place, not to attacks by birds.

Mice are very fond of this butterfly, as they are of most butterflies. In our operations we found that the bodies of discarded specimens dropped into the grass were invariably eaten by the next morning.

Remarks.—The records, taken in connection with the habits of this butterfly, would seem to indicate that it is probably common in some restricted area yet to be discovered between Silver Spring and Beltsville, Md., probably in the vicinity of Paint Branch.

As the localities suitable for *A. aphrodite* become less and less frequent southward, the butterfly becomes more and more closely restricted to small and increasingly widely separated areas. In North Carolina, while it is abundant wherever it is found, it is confined to the mountains and is reported, as I learn through the kindness of C. S. Brimley, only from Watauga, Avery, Buncombe, Henderson, and Jackson Counties.

Notes.—The two females at hand from the District (pl. 18, figs. 1, 2) are unusually large, the fore wing measuring 40 mm. and 42 mm. as compared with 39 mm. in the largest female available from eastern Massachusetts. Though the color below is somewhat paler than in the darkest Massachusetts specimens, the black markings in and about the cell on the fore wings above are heavier, and the olivaceous color extends to the outer end of the cell on the costal margin. The male scarcely differs from northern examples. The fore wing measures 33 mm. Like the females, it is pale below.

Although they are properly referable to *A. a. aphrodite*, the specimens from the District region show a very decided approach to *A. a. alcestis.*

While along the eastern seaboard from New England to North Carolina this species does not appear until the first of July or later, a month or more after the first appearance of *A. cybele*, at Waynesburg, Ohio, Clement W. Baker found the two species to appear at about the same time. In 1930 he took the first male of *A. aphrodite* on June 5 and the first female on June 14, while he took the first male of *A. cybele* on June 4 and the first female on June 8.

Genus EUPTOIETA Doubleday

EUPTOIETA CLAUDIA (Cramer)

Variegated Fritillary

Plate 21, Figures 1, 2

Occurrence.—Frequent, but not very common. It is found in moist open fields near streams. It is occasional in the meadows between Conduit Road and the canal 2 miles beyond Cabin John, in the damp portion of the fields across Blair Road from the Hyslop estate at Silver Spring, and in the National Zoological Park in the grassy spots along Rock Creek. I saw one in the Smithsonian Institution grounds in September, 1910, and Hugh Upham Clark saw one in the back yard of the house at 1818 Wyoming Avenue, on September 24, 1930.

Habits.—The variegated fritillary has a rather fast flight, progressing by a series of quick flaps alternating with rather long glides, during which the wings are rigidly extended horizontally. It usually flies about 3 feet above the ground, and maintains a constant level. Its flight is direct for some distance when it turns to one side or the other so very suddenly that the eye commonly fails to follow it. It is very quick in all its actions, and two belligerent males will tumble about in a most bewildering way until, their differences settled, each glides calmly off in a different direction.

This butterfly is very fond of flowers, and is frequently seen on goldenrod and other composites late in autumn.

Seasons.—My dates for the variegated fritillary are June 2 and 16, July 24 (when five specimens were taken at Cabin John all more or less worn), August 1, 3, 6, and 28, September 6, 17, 19, 20, and 24, and October 13. There are probably three broods, one late in May and early in June, the next in the last half of July and early in August, and the third in the latter part of September. But in regard to these we have no definite data for this region.

Of the three specimens in the Schönborn collection, one, a female, is dated September 2.

Remarks.—Farther south the caterpillars of this butterfly are sometimes destructive to pansies and violets.

NOTE

In addition to the species of Nymphalinae given in the foregoing pages, the following might be expected to occur in this region:

Vanessa milberti (see p. 244).
Vanessa j-album (see p. 245).
Polygonia faunus (see p. 245).
Dione vanillae (see p. 245).
Argynnis atlantis (see p. 246).
Brenthis bellona (see p. 246).
Phyciodes nycteis (see p. 247).
Phyciodes carlota (see p. 247).

Subfamily DANAINAE

Genus DANAUS Linnaeus

DANAUS PLEXIPPUS PLEXIPPUS (Linnaeus)

Milkweed Butterfly; Storm Fritillary; Monarch; Wanderer

Plate 6, Figure 4; Plate 58, Figures 1, 2

Occurrence.—Usually frequent, though not very numerous, everywhere in open country—particularly in low meadows—over which it is fairly evenly distributed; rarely abundant. Its numbers vary more or less from year to year, and it appeared in great abundance just after the middle of September, 1930. It is seen occasionally in the Department of Agriculture and Smithsonian Institution grounds, and in the parks and streets of Washington.

Twenty years ago this species was very common and frequently abundant in the District, but especially in the past 10 years its numbers have greatly decreased so that it is no longer one of the most familiar local insects. The decrease in its numbers has been due to the wide extension of building and landscaping operations in and about the District, for it is as common as ever not far away in Maryland and in Virginia.

In the District this butterfly apparently does not survive the winter. It is exceedingly scarce early in spring, at which season I have never seen it except near the river, in Potomac Park, in the Smithsonian grounds, and in the meadows west of Cabin John, and it is in this region, and also along the Eastern Branch, that fresh butterflies first appear in June.

I believe, therefore, that the District is repopulated each year from regions nearer the sea by butterflies which wander inland, following the banks of the river and of its larger tributaries. The adults from the eggs laid by these immigrants scatter widely over the District, and their successors become increasingly common and widespread until the end of the season.

Seasons.—The milkweed butterfly passes the winter in the adult stage and appears on the wing late in April or early in May, just before the milkweed (*Asclepias syriaca*) emerges from the ground. The females lay their eggs on the little plants soon after they first appear. Fresh butterflies are first seen early in June and increase in numbers throughout the summer, the species being most common in the middle or last half of September and continuing on the wing until the latter part of October. The autumn butterflies, which continue to emerge up to the very last warm days of the season, probably for the most part represent a third brood, some representing a second brood, and a very few a fourth brood. In the first frosts all the eggs, caterpillars, and chrysalids are killed, and the hibernating adults die during the winter.

Habits.—The flight of this butterfly is rather slow. Over flower-filled meadows it flies usually from 6 inches to a foot above the tops of the goldenrod and asters, progressing at the very leisurely rate of about 7 miles an hour. But over barren pastures it keeps 3 or 4 feet above the short grass and travels at the rate of about 15 miles an hour. It flies with a few rather slow flaps alternating with long glides during which the wings make with each other an obtuse angle of about 120° and the insect teeters or sways from side to side with a curious seesawing motion. From time to time the butterfly, in broad curves to one side or the other, slightly changes its course, but the same general direction usually is maintained. It is not given to quartering irregularly about within a more or less limited area, as are nearly all our other butterflies, but spends most of its life cruising along in an aimless sort of way. Late in summer the contrast between the manner of flight of this butterfly and that of the common clover butterflies (*Colias eurytheme* and *C. philodice*) frequenting the same fields is very striking.

The milkweed butterfly is particularly fond of flying along the seacoast or along the bank of a broad river, and it will do this even in the presence of a strong onshore or other wind. It is commonly observed flying over the sea far out of sight of land, and has been reported hundreds of miles at sea over the Atlantic. In crossing Massachusetts Bay from Boston to Provincetown late in summer in almost any year, one will see one of these butterflies every few miles, and sometimes one or more will be in sight for almost the entire distance. They are seen to be flying—always in a straight line—in any direction, though usually north, apparently because most of them come from Cape Cod, in marked contrast to the local pierids (*Colias philodice* and *Pieris rapae*), which when over the sea always fly against the wind.

On the south shore at Scituate, Mass., milkweed butterflies from time to time are seen coming in from the sea flying at a height of 300 or 400 feet, almost out of sight (Hugh Upham Clark). As soon as they are over the land they suddenly descend, almost as rapidly as if they dropped, to within a few feet of the ground.

Over water the flight is higher, more rapid, and more direct than it is over the land. The altitude is usually between 10 and 15 feet above the surface of the water, though sometimes much higher. The wings are moved continuously and rather rapidly, and there is no seesawing motion. The speed is usually between 20 and 25 miles an hour. Over water the insect is concerned only with covering all the distance possible, whereas over the land it is mainly concerned with surveying the ground beneath it. In long flights over water it gradually tires and sinks nearer and nearer the surface, so that well out to sea it is always seen flying very low.

Early in spring most of the butterflies that have come out of hibernation fly very low, within 4 to 6 inches of the ground or the tops of the dead grass blades, and they are then, with their faded and putty-colored wings more or less closely matching the ground beneath them, very inconspicuous, easily escaping notice.

In summer this butterfly is to be found spending the night hanging downward from the topmost leaves or shoots of herbaceous plants in the open fields, from the outer leaves of bushes or of trees, or from the smaller branches of bushes or trees, often at a considerable distance above the ground. It makes no effort whatever to hide itself, in marked contrast to the large fritillaries (*Argynnis idalia* and *A. cybele*), which early in the morning are never seen until they are on the wing.

The milkweed butterfly is a rather stupid insect and is not at all shy—indeed, most individuals may with care easily be captured with the fingers. It is difficult to frighten, but when thoroughly alarmed it flies rapidly and straight away at about double its usual speed with a continuous rapid and labored beating of its wings, gradually rising as it goes. Ordinarily after reaching a height of from 10 to 20 feet it ceases to rise, and slowly descends, keeping on, however, until it is out of sight. But sometimes it will fly diagonally upward until it is lost to sight at a height of 200 feet or more and a distance of several hundred feet. If there be trees or houses in its path it always rises and flies over them, never passing around them.

On emergence from the chrysalis milkweed butterflies immediately begin feeding, and for three days spend nearly all the time on flowers. On the fourth day they begin to lose their interest in flowers and become restless. From now on their time is largely spent in wandering about.

It is an obvious fact that practically all examples taken on flowers are fresh, and the fresher the individual the easier it is to catch. Old and worn individuals are seen commonly enough, but are more frequently observed in flight than on flowers. Early-spring examples I have never seen feeding—only on the wing.

Apparently the adult life of this butterfly is divided into two phases, a period of intensive feeding during which no sex instinct is manifested, and later a period of extensive wandering when feeding is relatively infrequent, in the latter part of which reproduction takes place.

Though this butterfly feeds on the flowers of a considerable number of different plants, it is particularly fond of the blossoms of the common (*Asclepias syriaca*) and the red (*A. incarnata*) milkweeds, the butterflyweed (*A. tuberosa*), and the red clover (*Trifolium pratense*). Late in summer it is especially to be seen on the flowers of the goldenrods (*Solidago canadensis* and other large species), the joe-pye-weed (*Eupatorium purpureum*), and the thistles. In its fondness for goldenrod it stands in sharp contrast to the swallowtails—and indeed to practically all the other late-summer butterflies—which are exceedingly partial to the thistles and pay little attention to the goldenrod if thistles are available.

When these butterflies are feeding, the wings are almost invariably tightly closed over the back, and the fore wings are drawn back as far as possible between the hind wings; but sometimes, especially in cloudy weather or after a rain, the males will feed with the wings extended horizontally. The milkweed butterfly feeds in any position, with the body from horizontal to vertical, or even extending at a considerable angle to the vertical beneath the point of support; but it prefers to feed with the body at a more or less considerable angle with the horizontal and the abdomen pointing diagonally downward. If there is any wind the insect always feeds on the lee side of the flowers. If frightened while feeding it almost invariably jumps directly upward in a line at right angles to the axis of the body before it flies away. It never ducks downward or darts off to one side after the fashion of the more active butterflies.

It shows a strong preference for flowers growing about 3 feet above the ground, and 3 to 5 feet above the ground may be considered as the habitual feeding level of this butterfly. It will descend to a foot to feed on clover or on the butterflyweed, or rise to 6 feet to visit the topmost flowers on a thistle. Almost invariably it chooses a flower more or less above, or at least not below, the general level of the herbage.

When feeding the females remain quiescent, but the males from time to time suddenly open their wings to an angle of usually about 60° and immediately close them again. This action, which makes them temporarily conspicuous from a long distance, may bear some relation to the flocking habits. If another individual comes too close to a feeding male the fore wings are suddenly drawn forward and a few quick menacing flaps are given, causing the newcomer to shy away.

The milkweed butterfly is occasionally noticed circling about muddy spots in roads or sitting on the mud and sucking up the moisture. But it can not properly be regarded as a "puddle butterfly."

This is a very peaceful insect. The males display almost no interest in one another. Occasionally two males are seen clumsily flopping about each other, but they usually part in a second or two, without having risen above the general level of their normal flight. More rarely these half-hearted combats last for several seconds, and the belligerent males will rise at a small angle to a height of 6 or even 8 feet above the vegetation; but the duelists seem never to suffer any injury. The viciousness displayed by the males of most butterflies toward one another is wholly foreign to the nature of the milkweed.

Persecution of other smaller butterflies is occasionally indulged in by the males of the milkweed butterfly. I once saw a male flying about 10 feet above the ground, turn from his course, and dive through a group of three males and a female of the yellow clover butterfly (*Colias philodice*), which were fluttering about together at about the same height, scattering them in all directions, and I have several times seen males dive like a hawk at yellow clover butterflies flying beneath them. Once I observed (at Newton, Mass.) a male repeatedly pouncing upon a cabbage butterfly (*Pieris rapae*), which dodged about near the ground trying to escape, and on another occasion, at Cabin John, Md., I saw a male fluttering about a battered female of the regal fritillary (*Argynnis idalia*), the two gradually rising to a height of about 15 feet.

But in spite of its essentially peaceful disposition the milkweed butterfly is not wholly without courage, for it will attack most viciously a hummingbird so incautious as to approach too near the flower on which it is feeding, always badly frightening the bird, which makes off in a straight line as fast as possible. After one of these attacks on a hummingbird the butterfly always displays intense excitement for some minutes. Prof. Walter K. Fisher tells me that Mrs. Fisher has seen this butterfly in the same way attack and put to flight a warbler at Pacific Grove, Calif. The Camberwell beauty (*Vanessa antiopa*) is the only other of our local butterflies that I have seen attack birds, and in this case small warblers (Mniotiltidae) are the victims. The attacks on birds by this last-named insect seem to be in the nature of routine performances and are not followed by any evident excitement.

The fundamentally peaceful nature of the large, conspicuous, and rather slow and clumsy milkweed butterfly seems to be well known to the other kinds of butterflies, and late in summer it is frequently persecuted by the pugnacious males of other species, particularly the pearl crescent (*Phyciodes tharos*), the buckeye (*Junonia lavinia*), the viceroy (*Basilarchia archippus*), and the hop merchant (*Polygonia comma*). It is almost invariably attacked if it happens to cross a road where these are disporting themselves, and the little pearl crescent is always ready to attack it—anywhere and at any time. When attacked it increases its speed, rises slowly upward, and dodges awkwardly about in an effort to shake off its pursuer. The obvious fear of the little pearl crescent—which could not possibly do it any damage—displayed by the milkweed butterfly is as ludicrous as it is difficult to understand.

In the milkweed butterfly all the surplus energy of both sexes seems to be expended in traveling, and these insects, especially the females, spend a far larger portion of their time upon the wing than do most butterflies.

The milkweed butterfly is remarkable in that there seems to be a minimum of difference in the actions and habits of the two sexes, and throughout the territory inhabited by it they occur in the same proportion—in practically equal numbers. In flight the males are readily distinguishable by their brighter color.

Mating takes place in open grassy fields, especially along the borders of woods. The eggs are laid for the most part on isolated milkweed plants or on the more detached peripheral plants of small scattered groups growing in open fields and especially along the borders of woods and along roadsides. Very often plants are chosen which are growing close to a building, wall, or fence. The eggs are seldom, perhaps under ordinary circumstances never, laid on plants growing in large dense stands.

When engaged in laying her eggs the female flutters about the plant in a somewhat clumsy way, from time to time hitting the leaves, finally perching on its summit and then slowly walking about and depositing the eggs. This process has been several times described. Only a very few eggs are deposited on a single plant. I have seen a female flutter about a small isolated wild cherry growing in an open field, hitting the leaves, drawing away, and then hitting the leaves again, finally perching on its summit just as if it had been a milkweed. She flew off, however, without depositing any eggs. The wild cherry projected for about a foot above the grass tops and from a little distance much resembled a milkweed.

This butterfly has been reported flying about electric lights at night.

Flocking and migration.—The milkweed butterfly is especially remarkable for its habit of gathering in enormous loose straggling flocks late in summer or early in autumn and migrating southward, and also for its habit of swarming in incredible numbers on the twigs and branches of trees and bushes. In some places the trees frequented by these insects in the swarming season have come to be known as "butterfly trees." But so far as known it does not migrate across the District, and at the present time it is not sufficiently numerous to swarm.

As an illustration of these phenomena the following observations from near-by Maryland are of interest; the quotation is from a letter from Dr. M. G. Ellzey, of Washington, written on January 20, 1887 (Insect Life, vol. 1, no. 7, p. 221, January, 1889), and the events described took place in 1886:

> About 7 o'clock in the morning my son, G. Murray Ellzey, called the attention of myself and several other gentlemen to the fact that "the whole heavens were swarming with butterflies." There were an innumerable multitude of them at all heights from, say, 100 feet to a height beyond the range of vision, except by the aid of a glass. They were flying due southward in the face of a stiff breeze. Observations upon the flight of individuals between points of known distances apart showed that the rate of movement was not far from 20 miles per hour. Where they originally came from or whither they went we could not tell. They undoubtedly came from beyond the bay, which, in that place, is 14 miles across, and they must have been early on the wing. By 11.30 o'clock the numbers had declined, and it was evident the bulk of the flight was over, but for several days a great many individuals, evidently following the migratory movement, were observed.
>
> My brother-in-law, Mr. Daniel Murray, who had been three days previously, viz., on the 20th of September, at Long Green, in Baltimore County, Md., saw a vast multitude of the same butterflies in migratory movement; they were seemingly exhausted in flight and settled on the trees in such multitudes as to give them the appearance of an autumnal forest. I was surprised at the great power of sustained flight exhibited, also at the great distance an individual butterfly could be seen by the unaided eye, at least across the water—not less than 1½ miles.

Doctor Fox mentioned (Proc. Ent. Soc. Washington, vol 1, no. 4, p. 207, 1890) having seen a large number of butterflies of this species crossing a large pond northward early in September, evidently flying with the wind.

In connection with the migratory and swarming habits of this butterfly the following observations are of interest:

At Cabin John when it appeared on September 17, 1930, in great numbers (following a rain on the preceding day) it was at first more or less evenly distributed over the fields, feeding everywhere on the goldenrod and also on the few and widely scattered thistles. On the next day (September 18) conditions were about the same, but sometimes as many as four or five would be seen about a single thistle. On the succeeding day (September 19) it was noticed that the butterflies had to a certain extent become gregarious. They were no longer evenly distributed over the fields, but were to be found in more or less widely separated areas where, for instance, from half a dozen to a dozen would be feeding on the goldenrod in a space 10 or 15 feet square, or from 6 to 10 would be seated on the heads of a large thistle, with others on the near-by goldenrod. Though in places 2 or 3 could be taken in a single sweep of the net, there would be none on the goldenrod for 200 feet or more between the little companies of well-separated individuals. Although their component individuals might be several feet apart, these little companies were constantly on the move. But they moved as individual butterflies, not as if the company were a unit. A butterfly would start up and fly for perhaps 100 yards, settling on a goldenrod some distance—5 or 10 feet perhaps—from another individual. Then a third would settle near these two, and soon another little company would be formed. Sometimes on being frightened a whole company would move off in the same general direction, but the individuals always seemed to scatter more or less. The procedure seemed to be, for the most part at least, a continual forming and breaking up of small and loose aggregations of independent individuals. But it was noticeable that the majority of the butterflies would keep within a certain area which was continually shifting north or south along the belt where the goldenrod was most luxuriant.

Though most of the butterflies flew only a foot or so above the tops of the goldenrod, one was seen (Hugh U. Clark) to drop from a great height, being first observed on the downward path about 100 feet above the ground.

On the following day (September 20) further changes had taken place. As we reached the field, at 2.30 in the afternoon, we saw within a few minutes' time four butterflies from 20 to 100 feet or more above the ground headed southward but drifting westward toward Great Falls before a moderate wind. This was in the western end of the field where the goldenrod is stunted and scattered and is not visited by these butterflies. Some minutes later a butterfly, which rose 5 or 6 feet away and which could not have been much frightened, mounted high into the air and departed in the direction of Great Falls.

Had the insects been more numerous this might well have been the beginning of a migratory flight. They acted as described for migrating butterflies and the fact that there were very few means simply that the supply was limited. We found later that the total number in the field seemed to be much reduced, and so we surmised that probably others had during the morning drifted away after the fashion of those we saw depart. They were more restless than they had previously been. They wandered about more and did not remain so long on the flowers. Also, their numbers had decreased considerably. Most of them were now gathered into two flocks, a small one of two dozen or so individuals in the northern half of the field, and a very much larger one in the southern half. Both flocks were more compact than any we had seen previously, and as many as four butterflies were often to be seen on a single goldenrod.

From the southern flock, which occupied an area, roughly, 100 feet long and 25 feet wide, we took 45 specimens for examination. We found that they had lost most or all of the violet iridescence, which in freshly emerged examples plays over the brown of the fore wings, while in practically all a few scales were lacking here and there on the undersurface of the fore wings, showing that they had been flying about for several days.

The restlessness of the individuals in both flocks was quite apparent, for they frequently shifted their position by flying a few feet. The increased sociability also was apparent. Whenever an individual that was flying over the field alighted, we always found that it had alighted near another or near several. The butterflies could not, however, be decoyed by a dead individual pinned to the goldenrod, although a male *Papilio philenor* was immediately attracted to and took a prolonged interest in a disabled and motionless black female of *P. glaucus*.

In the latter part of the afternoon individuals were seen flying toward one or other of the small trees scattered about the field. Examination of the trees, however, disclosed only a single individual clinging to a leaf. But we left before the time these butterflies usually retire for the night.

On September 24, just a week after their first appearance in large numbers in the fields beyond Cabin John, these butterflies were noticed at various places in the city of Washington, even in the business district. On the following day they were rather frequent about the city, always flying in a leisurely and aimless manner at usually about 8 or 10, but sometimes from 50 to 100 or more, feet above the ground.

On the succeeding day (September 26) a visit was made to the Cabin John meadows. In the northern half of the main field there were a few scattered butterflies feeding on the goldenrod and asters—perhaps a dozen were seen in all. This is but little in excess of what would be expected at this date in a normal season. Half a dozen of the butterflies were caught. One was freshly emerged, and the others were all fairly fresh—2 or 3, one possibly 4, days old, judged from the condition of the iridescence of the fore wings. Certainly none of them had been on the wing for as much as a week.

It was rather late and the insects were getting ready to spend the night. When feeding in the fields this butterfly always spends the night wherever night happens to overtake it, hanging from a goldenrod or aster or from an inclined sprig of some other plant. I have noticed that the lower fruiting shoots of *Agrimonia parviflora* are especially attractive at this season.

There were none of these butterflies in the southern half of the field, but an examination of a grove of trees south of the field disclosed two flying about among the trees in a desultory sort of way and occasionally perching on the underside of small dead limbs 8 or 10 feet above the ground. On the preceding day it had been reported to me by Hugh U. Clark that an individual had been seen in Rock Creek Park flying among the trees at a height of about 10 feet and perching on the lower side of branches. Some of the butterflies seen about the city were observed to light on the branches of trees, soon, however, resuming their aimless wandering.

It was apparent that all the butterflies that had emerged on September 16 and 17 had left the fields, with the possible exception of the two seen in the adjacent woods, though these were very likely younger. So far as these fields were concerned, the unusual abundance of these butterflies was a thing of the past; the population had now returned to normal.

The butterflies seen in Washington presumably drifted into the city from the surrounding country on every side, as there is no reason to suppose that the increase in the normal numbers of this butterfly was confined to the region about Cabin John.

A most peculiar fact in connection with the appearance of this butterfly in the meadows beyond Cabin John is that in these meadows its food plant (*Asclepias syriaca*) is not to be found. There are a few scattered plants of the red milkweed (*A. incarnata*) and of the butterflyweed (*A. tuberosa*), while the dogbane (*Apocynum cannabinum*) is abundant; but we have never found the caterpillars on any of these. Indeed, we have never found the caterpillars in the District area at all.

The occurrence of this butterfly in great numbers in areas from which its food plant is wholly absent has previously been noticed. It would seem that immediately upon emergence the insects seek a locality abundantly supplied with suitable flowers where they may gorge themselves with food with the minimum of effort.

Incidentally it may be mentioned that these butterflies were not the only arthropods to appear after the rain. Wood ticks and chiggers unexpectedly showed up, though in small numbers, the former to the extent of about 4 per cent of their early-summer frequency.

On September 23 there was a large flight of *Alabama argillacea* in the city of Washington. Whether this flight had any relation to rain south of this area remains to be determined.

In spring this butterfly is very scarce. In the last half of April and early in May females are sometimes to be seen along the river, usually flying a foot or so above the ground. They are very inconspicuous, their faded colors harmonizing with the color of the ground over which they fly.

On April 28, 1931, Dr. and Mrs. Torsten Gislén reported one flying westward along the Virginia shore of the Potomac rather high in the air, and when on the Maryland side of Great Falls on May 9, 1931, in company with Miss Dorothea Bates, Miss Doris M. Cochran, and Dr. Herbert Friedmann, I saw one flying slowly up the river before the wind about 20 feet above the cliffs just as it flies in the same region in the autumn.

The habits of this butterfly in spring, therefore, seem not to differ from the habits at any other season. The egg-laying females fly along hunting for the food plant in the same way in the spring as later in the year. They fly lower because the grass has only just begun to grow. The individuals seen by Doctor and Mrs. Gislén and by myself high in the air over the river banks were of unknown sex, but evidently they were traveling quite in the same way that is so characteristic of summer and autumn individuals.

Notes.—In freshly emerged individuals the entire upper surface of the wings, especially of the fore wings, shows in the sunlight a beautiful violet iridescence, which is particularly noticeable in the darker individuals and on the comparatively dark fore wings of females. This iridescence soon disappears, leaving only the bright steely reflections from the black veins.

There is considerable variation in the ground color of the underside of the hind wings, especially in the males. Females sometimes have the cell of the fore wings below with a band of white, narrowed in the middle, across the outer end. They rather frequently have a smaller or larger buff spot on both surfaces (whitish and larger beneath) in the interspace between veins M_3 and M_2 near the black border. The ground color of the upper surface varies considerably, some of the males being much brighter than others, and some of the females having the fore wings very dusky.

De Lancey Gill informs me that in 1896 his son, Capt. Robert Gill, captured a specimen in Rock Creek Park just beyond the limits of the National Zoological Park that was rather larger than usual and was entirely white on both surfaces.

In my personal experience with this butterfly in the District I have met with only minor variations.

In a male taken by Hugh U. Clark at Cabin John on September 19, 1930 (pl. 58, fig. 1), the two buff spots normally present just beyond the cell of the fore wings are absent, resulting in the appearance of a conspicuous black patch. This feature is quite characteristic of specimens of the middle American form *nigrippus*, at least in certain localities, as is shown by one from Porto Rico and another from Panama in the National Museum. In *nigrippus*, however, the large spots in the apical portion of the fore wings are white or whitish instead of buff.

In another male taken at the same time about 200 feet away (pl. 58, fig. 2) the black patch beyond the cell on the fore wings and the dusky suffusion beyond this are lacking, the ground color of the wings being continued to the apex, margined by a continuation of the black outer border and of the black costal border and crossed by veins narrowly black as in the rest of the wings. The buff spots occur as usual, but they are on a brownish-orange background. The black margin of the fore and hind wings has an outer row of small white spots and an inner row of larger buff spots. This feature, together with the reduction in the degree of black scaling on the veins on the upper surface, brings to mind the subspecies *erippus*, as illustrated especially by specimens in the National Museum from Castro, State of Parana, Brazil. The dark inner border of the fore wings and other features characteristic of the subspecies *plexippus* as opposed to *erippus* are, however, present.

Very frequently females show a sprinkling of bluish-white scales on the costal margin of the fore wings near the base. These may become numerous, when they are usually accompanied by a considerable sprinkling of white scales in the inner portion of the interspace between veins SM and M_1. There is sometimes in females a sprinkling of white scales along the margins of the black stripe forming the lower border of the cell on the hind wings, and along the earlier portion of the three veinlets running down from this. Females in which these white scales are numerous have a curiously frosted appearance.

The sexes of this butterfly are very nearly equal in numbers, the males being slightly in excess. Of 118 caught at random, 64 (54 per cent) were males and 54 (46 per cent) were females.

In size also the two sexes are very nearly equal, the males averaging very slightly larger. Dwarfs are frequent among females, but rare among males. In length of fore wing 64 males taken on September 18–20, 1930, measured from 48 mm. to 58 mm., averaging 52.8 mm., and 54 females measured from 40 mm. to 57 mm., averaging 51.7 mm. With four dwarfs omitted, the females averaged 52.3 mm., or only 0.5 mm. less than the males. The close correspondence in the size of the two sexes is shown by the fact that 12 of each had the fore wing 50–51 mm. long, 12 of each had it 52 mm. long, and 9 of each had it 54 mm. long; three males and 2 females had the fore wing 57–58 mm. long.

Range.—Originally this was an American butterfly, occurring from Nova Scotia, Hudson Bay, Saskatchewan, and British Columbia—in all these districts being of casual appearance late in summer—southward throughout North and South America, including most of the West India Islands, to Patagonia.

Shortly after the introduction of the milkweed into the Hawaiian Islands this butterfly appeared, about 1845 or 1850, and in 1857 it was found on Ponapé in the Carolines, not long after the first introduction of the milkweed into that island. About 1860 it was first seen on the Marquesas, in 1863 it appeared in the Tonga Islands, in 1867 on Tutuila in the Samoan group, and in 1869 on Upolu and Savaii in the same group, and also on Roratonga. It reached Lord Howe Island in 1870, Clarence River on the opposite coast of Australia in 1871, Melbourne, Australia, in 1872, and the Society Islands between 1870 and 1872. It soon became abundant over the greater part of the Pacific Islands and westward as far as the Andamans, extending southward to northern New Zealand and Tasmania, and northward to Formosa (Taiwan), where it is one of the commonest butterflies. Eastward across the Atlantic it has spread to Ascension Island and the Canaries, has been found in the Azores, and has been rather frequently reported from the coastal region of western Europe—Gibraltar, Portugal, France, and southern England.

It was probably first carried to these places by ships on which it happened to alight when more or less exhausted from a long flight over the water.

The typical northern form of this butterfly, which is the one which has extended its range to the Old World, occurs southward into Central America. In Central America, the West Indies, and northern South America it is represented chiefly by the form or subspecies *nigrippus*, in which the large buff spots near the apex of the fore wings are replaced by white and the two innermost are reduced in size or absent. Over most of South America it is replaced by the subspecies *erippus*, which lacks the dark inner (or lower) border of the fore wings and in which the veins on the underside of the hind wings are broadly margined with white. A closely related dwarf form occurs in the West Indies, and there are various other forms, more or less well marked, in the West Indies and in Central and South America.

Subfamily LIBYTHEINAE

Genus LIBYTHEA Fabricius

LIBYTHEA BACHMANII Kirtland

SNOUT BUTTERFLY

Plate 6, Figures 2, 3

Occurrence.—Very local. Mr. Shoemaker has specimens from Arlington County, Va., near the end of Free Bridge, and Dr. William Schaus has taken it in the same general region and also along the canal.

Remarks.—The snout butterfly passes the winter as an adult and appears in May. Fresh butterflies are seen throughout the summer. In this region there are probably three broods and a partial fourth.

This species grows more rapidly than any other of our butterflies. W. H. Edwards found that the time from the laying of the egg to the emergence of the adult is 15 to 17 days.

Except for the fact that it occurs, we know nothing of this species in the District.

The four specimens in the Schönborn collection, all of which are fresh, were taken on August 12.

Family RIODINIDAE

No species of this family has been recorded from the District or from its immediate vicinity. One species is to be looked for here, and there is a possibility that another might be found as a casual. Both are very small mothlike butterflies with the curious habit of resting on the undersurface of leaves with the wings spread out and resting on the surface of the leaf, like geometrid moths. Even if fairly common, they are likely to be overlooked. These are considered in the appendix (p. 247).

Family LYCAENIDAE

KEY TO THE LOCAL SUBFAMILIES

a^1. Hind wings not lobed at the inner angle.
  b^1. Hind wings below yellow-brown with large blotches of darker more or less outlined with white; wings above dull golden and dark brown ---------------------------------- **Gerydinae** (p. 129).
  b^2. Hind wings below whitish or buffy gray, with small black or dark-brown spots; wings above blue, or the fore wings coppery red and the hind wings dark gray ------ **Lycaeninae** (p. 131).

a^2. Hind wings with the inner angle produced and broadened, forming a distinct rounded lobe____________________ Theclinae (p. 138).

Subfamily GERYDINAE

The subfamily Gerydinae includes seven genera of dull little butterflies which are wholly, mostly, or largely black or dark brown above, with markings of bright brown, ochreous, or white, rarely of violaceous. They are distinguished from the other lycaenids most conspicuously by their curious legs, which are sometimes very long. The tibiae or tarsi are commonly elongated, or are otherwise peculiar.

The males have no secondary sexual characters, and usually do not differ in color from the females. They have a strong irregular mothlike flight, dancing about a favored locality or flying back and forth along a path, and are very loath to leave any particular spot. In some species they seem to become more active toward evening, but in others they fly only in the middle of the day, and only on sunny days. The females for the most part remain in partial shade, fluttering about among low bushes or the branches of trees.

So far as we know, all the butterflies of this group are carnivorous, the caterpillars feeding on aphids, coccids, jassids, and membracids, which are attended by ants.

The butterflies of this subfamily are found chiefly in southern Asia, but a few are found in Africa, and one inhabits the Eastern United States. In habits ours does not seem to differ appreciably from the related Old World species, particularly the species of *Gerydus*.

Genus FENISECA Grote

FENISECA TARQUINIUS (Fabricius)

ALDER BUTTERFLY

Plate 5, Figures 5 to 8; Plate 7, Figure 9; Plate 9, Figure 5; Plate 28, Figure 7

Feniseca tarquinius RILEY, Science, vol. 7, p. 394, Apr. 30, 1886; Amer. Nat., vol. 20, pp. 556–557, 1886.—W. H. EDWARDS, Can. Ent., vol. 18, pp. 141–153, Oct. 29, 1886.—RILEY, Can. Ent., vol. 18, pp. 191–193, Dec. 29, 1886.—A. H. CLARK, Smithsonian Ann. Rep. for 1925, pp. 439–508, 1926.

Occurrence.—Local and very erratic in its appearance, being common in or absent from the same locality in different years or at different seasons. It is undoubtedly a common butterfly in the District, taken as a whole, but its gypsylike manner of changing its haunts necessitated by the vicarious nature of its food supply makes it difficult to locate at any given time.

It is to be found about alders, beeches, or other plants growing along or near running water and infested with woolly aphids. In the summers of 1928 and 1929 it was common on the right bank of the

Northwest Branch just west of Blair Road at Silver Spring, and in 1929 I found it at Cabin John.

Habits.—This species flies with the greatest activity and in the greatest numbers on hot and sunny days. It is most active from about 10 a. m. until about 3 p. m., when it seems suddenly to disappear.

The flight about the food plants is rapid, nervous, and highly irregular, with frequent rests. As it dodges and skips about the alder branches it suggests a small and very active satyrid of the *Satyrodes eurydice* type. Its flight about the exterior of the alder thickets has been compared to that of *Orgyia antiqua.* Mr. Schaus has noticed its similarity to the flight of a riodinid. If badly frightened, it flies off very rapidly in a straight ascending line, or an ascending spiral, making an angle of about 30° with the ground.

It is very fond of flying up and down paths through alder thickets, or through the near-by woods. When so engaged the riodinidlike character of its flight is very obvious.

When resting the butterfly sits on the upper surface of a horizontal leaf with the head outward and the tail toward the center of the plant.

Emery said that it may be seen perched upon a branch of alder enjoying with the ants the honey exuding from the bodies of the aphids. It is fond of sucking moisture from damp mud along the side of streams. I have noticed that when sitting in the sunlight on the mud it turns so as to be at right angles to the sun's rays and then, like a satyrid, tilts its wings so that the sunlight falls perpendicularly upon them.

The hind wings are never moved alternately up and down in the manner so characteristic of most of the lycaenids.

Seasons.—Nothing definite is known regarding the number or the succession of the broods of this butterfly within the District. The six specimens in the Schönborn collection are dated August 9, 11, 17, and 18. The National Museum contains two specimens collected by Dr. Harrison G. Dyar on June 26, 1909, and one taken by Dr. August Busck on June 25, all three in Washington. The six specimens which I have caught were taken on May 30 (2), June 17 (2), August 28, and September 10; I also saw it on August 1. Theodor Pergande found caterpillars on July 8, August 8 and 23, September 18, and on October 2, and Mr. Edwards received caterpillars from Washington as late as October 4.

There should be a brood in the last half of April and early in May, another in the last half of June, a third in the middle of July, a fourth in the middle of August, and a fifth in the second and third week of September.

Remarks.—This butterfly is most easily secured in quantities and in good condition by gathering the caterpillars and raising them.

The caterpillars are found in the colonies of woolly aphids on the alder, beech, or other plants, usually living in flimsy silken tunnels underneath the aphids, though the fully grown ones may simply rest uncovered in the aphid mass. They are difficult to detect, but if the aphids be scraped off carefully they are easily discovered.

Late in the summer of 1931 the beeches along the Northwest Branch at Silver Spring were to a greater extent than usual infested with woolly aphids (*Prociphilus imbricata*). On September 19, James A. Hyslop, Foster H. Benjamin, and I found the butterflies common there, and also found many of the caterpillars. Most of the larger caterpillars were lying fully exposed among the aphids, chiefly on the upper side of the twigs, and the small ones were in tunnels. Mr. Benjamin found a few caterpillars in domiciles that had been made by fastening two leaves together with silk. He also found one about to pupate on the underside of a dead leaf on the ground.

The curious life history of the alder butterfly is given in the papers to which references are given. All of them mention specimens from Washington.

Subfamily LYCAENINAE

KEY TO THE SPECIES

*a*¹. Fore wings above coppery red with a brown border and some black spots; hind wings above dark grayish brown with a red submarginal band (pl. 22, figs. 7–10) ___ Chrysophanus phlaeas (p. 131).
*a*². Wings wholly or mostly blue above.
  *b*¹. Hind wings with a threadlike tail near the inner angle; two bright orange spots at the base of the tail; above violet blue, or blue more or less extensively suffused with brown (pl. 22, figs. 5, 6) ________________________ Everes comyntas (p. 133).
  *b*². No tails on the hind wings; above bright blue or blue and white, sometimes with the fore wings bordered with dark brown (pl. 22, figs. 1–4) ______________ Lycaenopsis argiolus (p. 136).

Genus CHRYSOPHANUS Doubleday

CHRYSOPHANUS PHLAEAS HYPOPHLAEAS (Boisduval)

COMMON COPPER

Plate 22, Figures 7 to 10

Occurrence.—Very local and usually infrequent, but occasionally rather common or even abundant in restricted areas. It is to be found in dry and more or less barren localities and about farms wherever the common sorrel (*Rumex acetosella*) grows. The only places where I have found it are on a dry hillside in Rock Creek Park, at Cabin John, at Silver Spring about a large hayrick and along a dry ditch in an adjacent field, and in fields and on dry hillsides at Beltsville and Riverdale, Md. Mr. Shoemaker has specimens from Arlington County, Va., where I have seen it in some numbers, and it is represented by five specimens from the District in the Schönborn collection.

Habits.—The flight of this little butterfly is very characteristic. It flutters rather rapidly along, sweeping irregularly first to one side then to the other and often doubling on its course. The flight is never long, for the little creature soon alights on the summit of a weed or on a leaf with the wings closed and the fore wings drawn well forward, exposing the black spots on the underside. It flies only 2 or 3 inches above the grass tops, and 6 inches to a foot above bare ground.

It is very fond of sunning itself on the bare ground, stones, or leaves with the wings halfway expanded. It is often to be seen sucking moisture from the mud. It is very fond of flowers, particularly of the flowers of the clovers.

The males are much more active than the females and their flight is more irregular and usually longer. They are very aggressive and Mr. Scudder has noticed that they will "even assault the monster Carolina locust (*Dissosteira carolina*)." This unhappy insect is tormented by all the aggressive butterflies in this region. I have noticed six other species chasing it. These are, in the order of the frequency of the performance, *Phyciodes tharos*, *Basilarchia archippus*, *Junonia lavinia*, *Pyrgus tessellatus*, *Pyrameis cardui*, and *Vanessa antiopa.*

In settling their differences the belligerent males of the common copper do not rise into the air as do so many butterflies, but always keep near the ground.

Mr. Scudder has remarked that this is one of the first butterflies to appear after sunrise, and one of the last to disappear at nightfall.

Seasons.—The common copper appears about the end of April and by the first week in May has become common. This brood continues on the wing until about the first of June. The second brood begins to appear in small numbers about the middle of June, and by the end of the third week in June the individuals have become numerous. The butterflies of this brood, which are much more abundant than those of the spring brood, fly until after the first of August. The third brood appears about August 1, and fresh butterflies increase in numbers for nearly two weeks, continuing to emerge for at least three weeks. A fourth brood appears early in September, and the insect continues to fly until the end of the season. It is possible that there is a partial fifth brood early in October.

Notes.—The individuals of the first brood differ slightly from those of the later broods. The ground color of the fore wings is clearer, there being less infuscation toward the base, and the black spots on the fore wings are smaller and therefore more isolated. The inner spot in the cell on the fore wings is much smaller than the outer, the difference between the two being greater than in summer specimens. The small tooth, or sometimes very short hairlike tail, near the anal angle of the hind wings, which is seen in summer specimens, is only faintly indicated.

Remarks.—Early in July, 1928, this butterfly was unusually common at Silver Spring and was to be found scattered all about the fields in the vicinity of the hayrick mentioned above. As many as 15 or 20 could be captured in a single afternoon. In the last half of June, 1929, it was abundant in a dry pasture near the agricultural experiment station at Beltsville and unusually common at Cabin John.

The common copper has an enormous range. It is found from Nova Scotia and Cape Breton to James Bay, Alberta, and British Columbia, and from Japan and Amurland to Scandinavia and England; southward it extends to Georgia and Texas, northern India, the oases of the Sahara, and the Canary Islands. It is geographically and also seasonally variable, least so in America and most so in southern and eastern Asia. An extraordinary number of aberrations have been described, but none of these are known from the District.

Genus EVERES Hübner

EVERES COMYNTAS COMYNTAS (Godart)

Tailed Blue

Plate 22, Figures 5, 6

Lycaena comyntas Marlatt, Proc. Ent. Soc. Washington, vol. 1, no. 4, p. 206, 1890.

Occurrence.—Very abundant—one of the most abundant butterflies in the District.

The tailed blue is found everywhere in open country, being most numerous in weedy pasture land with an abundant growth of asters.

Habits.—The tailed blue has a rather nervous, somewhat skipping flight suggesting that of the least skipper (*Ancyloxypha numitor*) though more hurried, but the males sometimes and the females usually fly at a constant level of from 4 to 6 inches above the ground, dodging irregularly among the grass blades but always maintaining the same general direction. The flight is never long, and the butterfly soon alights, usually on the upper surface of a horizontal leaf. On alighting the butterfly holds the wings parallel to each other above the back, or very slightly divergent, and moves the hind wings forward and backward, moving those on either side alternately, for a few seconds. The females are less active than the males, and their flights as a rule are shorter.

This little butterfly is very fond of flowers, especially of the flowers of small leguminous plants more or less hidden in the grass. It shows a decided preference for white flowers and will rise above the grass tops to the flowers of the wild carrot and of small white asters. It is extremely fond of the flowers of the butterflyweed, of the button-snakeroot, and of the white sweetclover (*Melilotus alba*).

The males enjoy sucking the moisture from muddy spots in roads, which they do singly or in little scattered companies.

Like the common blue (*Lycaenopsis argiolus*), the tailed blue seems to live at peace with the rest of the insect world. It is not aggressive, and nothing seems to trouble it. I have never seen one caught by a crab spider or a phymatid bug or by an ant, although it is the commonest butterfly in the regions where the two first are most abundant.

Dr. Charles L. Marlatt has reported an interesting case of the swarming of this butterfly in the District. He says:

> About the middle of July, 1888, the writer's attention was drawn to the large numbers of small butterflies, of the species above named, flitting with irregular but rapid flight back and forth at a height of 25 to 30 feet from the ground above some elm trees which grew alongside a large field of red clover. Occasionally one would rest for a second or two on the upper part of an elm, only to quickly resume its place in the swarming mass above.
>
> No easy explanation of the peculiar congregating of these butterflies presents itself. So far as observed, it was not a nuptial flight—no union of the sexes occurred. There was no general movement in any direction, but their actions seemed rather of a playful or frolicsome nature. They had evidently come together from the clover-field mentioned, in which they had been breeding abundantly.
>
> A threatening storm of wind and rain coming on at the time may have had something to do with their collecting into swarms.
>
> An additional instance may be given, which indicates still further a semi-gregarious habit with these insects. The writer has observed them in late summer covering moist patches of ground in such numbers that a single sweep of a net would capture 50 or more of them. Their object in this instance was evidently to suck up the moisture, the extremely dry weather having doubtless greatly reduced the supply of nectar in the clover blossoms.

The probable explanation of the congregating of these little butterflies above the elm trees is a rather simple one. They are fond of flitting about where the grass is short and sparse, and therefore would tend to linger in the thin grass under the elm trees. On a day such as the one described there would have been strong currents of air rising from the ground around and above any objects of considerable height, such as the elm trees. The butterflies were undoubtedly caught in ascending currents of air and swept upward to the treetops, where they escaped into the eddy just above the trees from which they were unable to escape because of the strong upward drafts on every side.

Seasons.—The tailed blue first appears at the end of the first week of April, and in a few days becomes common. It remains abundant until toward the middle of May, when its numbers begin rapidly to decline. Fresh individuals appear early in June, and it is soon again abundant. In the latter part of June the numbers fall off, but fresh specimens are seen about the first of July, and by the end of the first week in that month the butterfly is once more abundant. The fourth brood, in which the individuals are most numerous, appears toward the middle of August and flies in abundance until about the end of the first week in September, the numbers then declining. Individuals continue to emerge, however, until after the middle of September, and the butterfly is found in small numbers until the end of the season.

Notes.—When compared with specimens from the vicinity of Boston males from the District are seen to be bluer with a narrower dark border. Females from the District are dark brown almost always heavily dusted with violet-blue scales, which on the fore wings occupy a rounded triangular area extending from the base to the outer end of the cell and to the lower angle, and on the hind wings cover more or less completely the inner half. Rarely females from the District are plain brown, as are all the females which I have seen from the vicinity of Boston. In both sexes the color of the underside is slightly lighter and more uniform in local individuals than in those from Boston. These differences, as between southern and northern examples, were long ago noticed by Mr. Scudder.

The length of the fore wing in 16 males at hand varies from 10 mm. to 13.5 mm., averaging 12.3 mm.; in 4 females it ranges from 11.5 mm. to 14 mm., averaging 12.2 mm. In 6 males from the vicinity of Boston the fore wings vary from 9.5 mm. to 14 mm. in length, averaging 12.9 mm., while in a female the fore wings are 12.5 mm. long. These last averages are practically the same as the figures given by Mr. Scudder. The insect therefore is smaller about Washington than it is about Boston.

It has been noticed that in this species there is no regular intergradation between the larger and the smaller individuals, the butterflies occurring in a larger and a smaller size. This is as true here in the first as in the later broods, though the very first butterflies of both sexes are always small. Individuals of both sexes with the fore wings not more than 10 mm. long are always to be seen, though they are less numerous than the larger.

Genus LYCAENOPSIS Felder

LYCAENOPSIS ARGIOLUS PSEUDARGIOLUS (Boisduval and Le Conte)

Common Blue

Plate 22, Figures 1 to 4

Occurrence.—Common, but not abundant, throughout the District. The common blue is a butterfly of open deciduous woods and brushy land. It is especially to be found along the edges of woods, in moist glades and clearings, along woodland roads and the banks of wooded streams, and particularly in brushy bogs more or less surrounded by woods. It is much more abundant in the bog at Beltsville and in the woods along Paint Branch than elsewhere.

Habits.—The flight of the common blue is very meandering and irregular, the butterfly flying from side to side, frequently doubling on its tracks, and sometimes rising to a considerable height. The wing beats are rather slow so that the flight appears leisurely. The males wander about in a curiously languid manner, pursuing an extremely tortuous course. In the open they fly rather high for such a small butterfly, 1 or 2 feet above the ground or grass tops. On encountering a bush or a tree they will rise and fly back and forth and up and down about it, sometimes reaching a height of 15 or even 20 feet. Their flights are as a rule much longer than those of our other lycaenids. The flight of the females is as leisurely as that of the males and is of the same general character. It is, however, rather lower and somewhat less irregular. The females very seldom rest upon the ground, or rise more than 4 or 5 feet above it.

Though the males are rather widely distributed, the females remain close to shrubbery and weedy areas in open woods or in damp pastures adjacent to woods. The males, though wanderers to a considerable extent, are much given to remaining in one particular locality, constantly exploring the vicinity from the ground to 10 or 15 feet or more above it.

The males are fond of sucking moisture from mud and are frequently seen about puddles, in this region usually singly, sometimes two or three together. They are also fond of carrion and filth.

Both sexes are fond of flowers, especially white flowers. They are seen most frequently on the flowers of *Spiraea latifolia*, as that plant grows commonly in the region where they are most numerous.

Seasons.—The common blue first appears in small numbers about the last week, or even about the middle, of March and becomes common in the first week of April. The females appear a few days after the males. The butterflies continue to emerge until about the last week in June and disappear shortly after the first of July. About the first of July individuals of a new brood appear. These slowly increase in numbers and become abundant in the last week of the month and the first week in August, after which their numbers decline. A third brood, composed of relatively few individuals, appears early in September and flies until about the middle of the month.

Notes.—The butterflies of the first brood are of three quite different forms. The earliest to appear are of the form *lucia*, which I have found common along Paint Branch and frequent at Cabin John in the last half of April and in the first week in May. There are specimens in the Schönborn collection dated April 27 and May 3, and Mr. Shoemaker has taken it in the last of April. The Schönborn collection includes specimens of *violacea* taken on April 13, 14, and 20, Mr. Shoemaker has specimens taken the last of April, and I have a series including both sexes taken on May 25; but I have also taken it commonly in the last half of April when it was flying together with the form *lucia*. These two forms appear practically simultaneously, but *lucia* soon disappears while *violacea* emerges over a rather long period.

The form *violacea* here occurs both in the usual violet phase and in a blue phase in which there is little, if any, trace of violet.

In June the summer form *pseudargiolus* (or *neglecta*) appears. In the Schönborn collection there is a series of six taken on June 12 and I have a pair taken on June 17 and a female taken on June 23. It is possible that these June specimens may be the young of earlier individuals of the forms *lucia* or *violacea*, but in view of what is known about this species elsewhere I have considered them as belonging to the spring brood.

These early individuals of the form *neglecta* differ from those found later in the summer. The males are somewhat paler and have a slight violet tinge; the hind wings are very indistinctly marked, being heavily dusted in the light areas with blue scales. The females are dull, and the light areas on both wings, which are not sharply defined, are rather heavily dusted with blue or light brownish scales.

The late July males of the form *pseudargiolus* are usually very brightly colored. The fore wings are brilliant blue with a very slight violet tinge. The outer border is black, at the apex for about the width of an interspace, gradually tapering to a fine line at the lower angle. The hind wings have a threadlike margin of black followed by a blue border broader than an interspace, which becomes indistinct and narrow anteriorly. The remainder of the hind wings is white, crossed by blue veins and with a more or less heavy blue dusting basally and along the costal and especially the abdominal border. In some individuals the white on the hind wings is more or less completely obscured by blue scaling. The females have the blue scaling confined mostly to the base of the fore wings, with scattered blue scales on the basal portion of the hind wings, and there is a distinct, but not brilliant, blue reflection over the entire light area of the fore wings.

Specimens taken in the vicinity of Boston in July and August most nearly resemble those taken in the District in June. In the males the hind wings are never so brightly marked as in most of those taken in late July. They are also somewhat paler and are often tinged with violet. In the females there is more blue on the fore wings and the blue reflection over the whitish area is stronger.

Eleven males of the form *violacea* from the District measure in the length of the fore wings from 12 mm. to 15 mm., averaging 14 mm. Five females measure from 13 mm. to 14 mm., averaging 13.8 mm. Mr. Scudder gives the average of both sexes as 14 mm.

Ten males of the form *pseudargiolus* (or *neglecta*) from the District measure from 13.5 mm. to 16 mm., averaging 14.9 mm. Five females measure from 14 mm. to 15.5 mm., averaging 14.7 mm.

Four males of the form *pseudargiolus* from the vicinity of Boston taken in July and August measure from 14.5 mm. to 16.5 mm., averaging 15.5 mm. Twelve females from the same region measure from 12.5 mm. to 15.5 mm., averaging 14.2 mm.

NOTE

In addition to the foregoing species of Lycaeninae the following may possibly occur in the District:

Chrysophanus thoë (see p. 248).

Glaucopsyche lygdamus lygdamus (see p. 248).

Subfamily THECLINAE

KEY TO THE SPECIES

a^1. Hind wings without tails.
  b^1. Hind wings below with a submarginal row of large bright red spots, and also numerous scattered small black spots conspicuously ringed with white (pl. 24, figs. 1, 2). Strymon titus (p. 141).
  b^2. No red spots on the under surface of the hind wings, and no scattered black spots ringed with white.
    c^1. Underside of hind wings with the inner half similar to the outer, both crossed by irregular or jagged very dark lines, the central one narrowly bordered with white outwardly, giving an irregularly checkered effect; border of hind wings conspicuously scalloped (pl. 25, figs. 9, 10) ________________ Incisalia niphon (p. 145).
    c^2. Underside of hind wings with the inner half darker than the outer, from which it is separated by a very irregular line, and unmarked.

*d*¹. Hind wings with an even and unscalloped border, beneath plain brown, lighter in the outer half (pl. 25, fig. 7).
Incisalia augustinus (p. 142).

*d*². Hind wings with a scalloped border, beneath with an overwash of whitish scales in the lower two-thirds of the outer half.

*e*¹. Hind wings beneath with the ground color similar throughout, only slightly darker in the inner half; outer half of lower two-thirds thickly flecked with whitish scales; more or less evident white scaling in a broad band along the inner margin; band across middle of outer half of fore wings below scalloped and very irregular; male with a conspicuous stigma on the fore wings (pl. 25, fig. 8) -- Incisalia irus (p. 145).

*e*². Hind wings beneath with the inner half very dark brown, contrasting strongly with the much lighter outer half, uniform in color or with a large indefinite area of olive or lighter brown scales near the anterior border; no whitish scales near the inner border; hoary scaling confined to a broad definite or indefinite band in the hinder two-thirds of the wing which seldom extends inward beyond the row of spots or crescents in the light outer portion; band across underside of fore wing in middle of outer half not scalloped, parallel to the outer border, usually with the lower half abruptly nearer the outer border than the upper; male without stigma------ Incisalia henrici (p. 145).

*a*². Hind wings with a hairlike tail, or two tails, near the inner angle.

*b*¹. Wings above vivid iridescent blue broadly bordered with dark brown (pl. 23, figs. 1, 2)---------------- Strymon m-album (p. 140).

*b*². Wings above brown or grayish brown.

*c*¹. Undersurface of wings dark green with a narrow submarginal white line, which becomes tortuous on hind wings; above golden brown (pl. 25, figs. 3, 4)--- Mitoura gryneus (p. 142).

*c*². Brown or gray beneath.

*d*¹. Undersurface dark gray with a fine line of white interiorly bordered with black and brownish red in the outer third of the wings, and conspicuous orange markings at the base of the tail; above brownish gray with a broad orange crescent at the base of the tail (pl. 23, figs. 5, 6)-------------------- Strymon melinus (p. 140).

*d*². Beneath brown with an orange crescent or chevron at the base of the tail and a conspicuous blue patch between it and the inner angle; above brown with a small orange mark at the base of the tail.

*e*¹. Outer portion of the cell in each wing crossed by a dark bar bordered with white (pl. 24, figs. 7, 8).
Strymon calanus (p. 142).

*e*². No markings within the fine line, white bordered interiorly with dark, that delimits the outer third of the wings (pl. 23, figs. 7, 8)------------ Strymon ontario (p. 141).

Genus STRYMON Hübner

STRYMON M-ALBUM (Boisduval and Le Conte)

Azure Hairstreak

Plate 23, Figures 1, 2

Occurrence.—Very irregular in its occurrence, sometimes rather common but usually scarce and frequently not to be found at all. It was found rarely in 1926, was rather common in 1927, but has not been reported from this area since, although Dr. E. A. Chapin took it at Falls Church in 1928. Whenever it occurs it is generally distributed in moist open fields and on hillsides near woods, being the most generally distributed of all our hairstreaks with the sole exception of *Strymon melinus.*

Mr. Shoemaker has about 12 specimens, all taken between April 20 and May 1, and one of the five specimens in the Schönborn collection was taken on April 21. Dr. E. A. Chapin captured one on July 4, 1928, at Falls Church, Va. One of the specimens in the Schönborn collection was taken August 14, and I have one taken August 27, 1926, at Cabin John (A. B. J. Clark), and four taken September 2, 1927, at Silver Spring. Mr. Shoemaker once saw an old worn individual in September.

Seasons.—There would seem to be three broods in this region, one in the last half of April and May, one in the last half of June and early in July, and one in the last half of August extending into September.

STRYMON MELINUS MELINUS Hübner

Gray Hairstreak

Plate 23, Figures 5, 6

Occurrence.—Common, though not abundant, in open fields throughout the District area, and sometimes found in the more open woods. It is the commonest of the hairstreaks in this region.

The Schönborn collection contains specimens taken on August 11 and 13. The National Museum contains a specimen from Washington taken by Mrs. D. H. Blake, and three others from Washington without further data.

Habits.—This little butterfly has a rapid and very erratic flight, always keeping near the ground. Its flight is so fast and it is so small that it is seldom noticed unless perched on a flower. When startled it seems to vanish after flying a few yards. Early in spring it may be found on the flowers of *Barbarea vulgaris*, and later on clover, milkweed, and thistles.

Seasons.—The gray hairstreak appears about the last of April, and becomes frequent early in May. There are probably three broods, but the insect seems to be continually on the wing from the time of its first appearance until the end of the season. My dates of capture are May 3, 9, 23, 30, and 31; June 6 and 17; July 17; August 1, 3, and 27; and September 7, 12, and 19.

STRYMON ONTARIO ONTARIO (Edwards)

ONTARIO HAIRSTREAK

Plate 23, Figures 7, 8

Occurrence.—Ernest Shoemaker captured two specimens of this rare little butterfly at Difficult Run, Fairfax County, Va., on June 26, 1920. They were feeding on the flowers of Jersey-tea (*Ceanothus americanus*).

Dr. William T. M. Forbes writes me that he regards Edwards's *Thecla ontario* as the northern form of *T. autolycus.* The specimen figured on the plate, the origin of which is not known, was determined by Mr. Scudder as *T. autolycus.* It possibly came from the vicinity of Boston, as a number of specimens recorded from that region can not now be located.

STRYMON TITUS MOPSUS (Hübner)

CORAL HAIRSTREAK

Plate 24, Figures 1, 2

Occurrence.—Rare. Mr. Shoemaker has a specimen taken at Glencarlyn, Arlington County, Va., on the flowers of Jersey-tea (*Ceanothus americanus*) June 24, 1913, and I have a pair taken on the flats below Chain Bridge on the flowers of milkweed (*Asclepias syriaca*) June 30, 1923, and a female taken at Cabin John August 1, 1926.

Remarks.—This insect is single brooded and passes the winter in the egg.

Notes.—The specimens from the District (pl. 24, figs. 1, 2) differ from others at hand from localities near Boston (pl. 24, figs. 3–6) in having the small dark spots on the undersurface of the wings conspicuously bordered with white, and in having the submarginal red spots on the undersurface of the hind wings smaller and therefore more widely separated. The submarginal red spots on the undersurface of the fore wings, which are conspicuous in northern females and present, though much reduced, in northern males, are wholly lacking, though the black chevron inwardly bordered with white just within these spots is retained.

The fore wing in the local male at hand measures 17 mm. In the two females it measures 18.5 mm. and 16.0 mm.

STRYMON CALANUS (Hübner)

BANDED HAIRSTREAK

Plate 24, Figures 7, 8

Occurrence.—Rare. Mr. Shoemaker has a specimen taken at Difficult Run, Fairfax County, Va., on June 20, 1920, and another taken at Glencarlyn, Arlington County, Va., on June 24, 1913. There are two specimens in the Schönborn collection from the District without dates, and I have a much worn one taken at Silver Spring, Md., on July 24, 1927.

Remarks.—There is only a single brood a year. The insect passes the winter as a caterpillar just from the egg which does not feed until spring, or in the egg.

Genus MITOURA Scudder

MITOURA GRYNEUS GRYNEUS (Hübner)

OLIVE HAIRSTREAK

Plate 25, Figures 3, 4

Occurrence.—Not rare, but very local and found only about cedar trees (*Juniperus virginiana*) on hillsides.

I have specimens taken on April 27 and May 4, 1930, at Cabin John. There are six specimens from the District in the Schönborn collection, and Mr. Shoemaker has taken it on cedar trees in Arlington County, Va., over Free Bridge, from April 18 to May 1. In the National Museum there are three specimens from Plummers Island, Md., one collected by Dr. E. A. Schwarz on April 12, 1908, one taken by Dr. August Busck on April 14, 1908, and the third simply dated April, 1908.

Remarks.—There are two broods, one in the last half of April and early in May and the other in July.

Genus INCISALIA Minot

INCISALIA AUGUSTINUS (Westwood)

BROWN ELFIN

Plate 25, Figure 7

Occurrence.—Very local, but common where it is found. Dr. G. P. Engelhardt tells me that in May, 1920, he found this butterfly common about the rocky cliffs on the Virginia side of the Potomac opposite Plummers Island.

I did not meet with this species until 1931, when I found it rather common along the edges of the woods bordering Paint Branch, and fairly frequent in the bogs and other open places in the woods.

There is a specimen in the Yale University Museum collected by Charles R. Dodge in the District and recorded by Mr. Scudder in 1889, and another in the National Museum taken by Dr. G. P. Engelhardt on the Virginia side of the Potomac opposite Plummers Island on May 11, 1920.

Season.—I found this species most common on April 29, the first day on which I was so fortunate as to meet with it. About a dozen were seen, and 4 worn specimens, 1 male and 3 females, were captured. Other worn and broken females were taken on May 3 and May 9. Doctor Engelhardt's specimen, taken on May 11, is fresh.

The butterfly probably appears in March or early in April and flies until about the middle of May.

Mr. Scudder says that in New England this species always precedes *I. irus* by a few days in places where both occur, and Messrs. Cook and Watson say that in New Jersey it appears from a week to 10 days earlier than either *I. irus* or *I. henrici*. It doubtless precedes these species by a week or so in the District, although we have no definite records.

Habits.—Mr. Scudder said that this butterfly prefers rocky heaths where *Vaccinium* and other low shrubs grow in patches, and is fond of alighting upon rocks or upon dead twigs lying on the ground. Dr. Walter Faxon has noticed that it is partial to *Antennaria*.

In the vicinity of Boston I have found it abundant about lichen-covered rocks in woods with numerous pines and *Vaccinium*, where it flies with the various species of *Thanaos*. Doctor Engelhardt found it here amidst similar surroundings.

Each season I have searched for it about the rocks and cliffs on the Maryland side of the Potomac, but have never found the slightest trace of it.

On April 29, 1931, when searching for salamanders in company with Dr. and Mrs. Torsten Gislén, of Uppsala, Sweden, and Miss Doris M. Cochran, I most unexpectedly came across this butterfly in some numbers along the borders of the woods in the Paint Branch Valley, and also found it in the bogs and other open places in the woods. Though pines and *Vaccinium* are abundant here, there are no bare rocks. As usual, it was flying with large numbers of several species of *Thanaos*, especially *T. juvenalis*, *T. horatius*, and *T. brizo*.

This little butterfly has a rather feeble, slow, and fluttering flight and, as Mr. Scudder says, seldom rises more than a foot or two above the ground even when alarmed. It is unusually sluggish for a hairstreak, and its flights are always short. It is very unsuspicious and stupid, and with due caution may easily be captured with the forceps. The males are more alert and active than the females, though they are by no means so active as the males of the species of *Strymon*.

This species is very fond of sunning itself on stones, sticks, or dead leaves lying on the ground, or on the leaves of herbaceous plants or bushes. It usually chooses leaves only a few inches from the ground, but sometimes is seen as high as 5 feet above the ground. Very frequently it will fly into a bush and rest on the twigs instead of alighting on the leaves. It is especially partial to *Vaccinium*, although I have never seen it pay any attention to the flowers. It rests with the wings closed and without any reference to the sun or to the center of the plant on which it may happen to be. After alighting it nervously moves about for a few seconds, raising and lowering the hind wings alternately in the manner so characteristic of this group.

If badly frightened when perched on a leaf or twig near the ground it will sometimes simply drop and lie on its side on the dead leaves, or crawl in among them. In such a position it is exceedingly difficult to detect.

This little butterfly is easily overlooked. It appears before the leaves, and its sluggishness, small size, and plain dark colors, which harmonize wonderfully well with the twigs and dead leaves on which it loves to rest, render it very inconspicuous. This inconspicuousness is in striking contrast with the conspicuousness of the other types—the common blue, the orange tip, the cabbage butterfly, the vanessids, the early swallowtails, and the species of *Thanaos*—which are on the wing at the same time.

Comparisons.—In a series of seven females and a male from Paint Branch the fore wing is 12–14 mm., usually 13 mm., long. These specimens agree well with a series from the vicinity of Boston, but most of them have a more or less conspicuous small patch of rusty orange just beyond the cell of the fore wing, and two rather large rusty spots near the anal angle. Beneath most of them are darker than specimens from New England, with the contrast between the dark basal and the light outer portion of the hind wings less marked. There is a dull orange suffusion on the fore wings and a purplish suffusion on the hind wings.

Two of the specimens are scarcely distinguishable from the usual type found about Boston, while occasional specimens from Boston resemble local individuals.

INCISALIA IRUS (Godart)

FROSTED ELFIN

Plate 25, Figure 8

Occurrence.—Frequent, but very local. Mr. Shoemaker has found it in Arlington County, Va., over Free Bridge, from April 18 to May 1 on flowers, and of the four specimens from the District in the Schönborn collection three are dated May 3.

Habits.—Like *Incisalia augustinus* this is a sluggish species and always keeps near the ground. It rests on the ground, or on the leaves of herbaceous plants, or on the lower leaves of bushes. It is less given to concealing itself than *I. augustinus*, and consequently is more easily found.

INCISALIA HENRICI (Grote and Robinson)

Occurrence.—I have met with this species only in the lowest of the bogs near Paint Branch, where I took one on May 3, 1931, and another on May 9, 1931. Both were much broken. The first was resting on a huckleberry bush about 5 feet above the ground and the other was on a small blueberry 4 or 5 inches from the ground.

Remarks.—This species has been frequently confused with *I. irus.* Mr. Scudder regarded *henrici* as a synonym of *irus*, and his colored figure represents *henrici* and not *irus.*

This species seems to be especially partial to the redbud (*Cercis canadensis*). Abbot said that it frequents the blossoms of the redbud in old fields on the borders of swamps. In the National Museum collection there are four specimens from Cadet, Mo., taken on redbud on March 2, 26, and 30 and April 4, 1896, and also three pupal skins taken on redbud on March 30 and April 4 and 13, 1896.

INCISALIA NIPHON NIPHON (Hübner)

BANDED ELFIN

Plate 25, Figures 9, 10

Occurrence.—Generally distributed in pine woods and in woods with numerous pines, and locally rather common. It often wanders rather widely out over fields adjacent to woods and frequently visits gardens.

Mr. Shoemaker has found it common on pines in Arlington County, Va., over Free Bridge, from April 18 to May 1, and I have specimens from the same region taken on June 17. I have seen it in Rock Creek Park and in woods across Sixteenth Street from the Walter Reed Hospital in May.

It is most numerous in the woods along Paint Branch, where it is found especially along their borders and in the bogs and clearings, also wandering rather widely over the near-by fields.

Season.—The banded elfin appears about the middle of April or slightly before, and is most common toward the end of that month and in the first half of May. It continues to fly until after the middle of June.

Habits.—This little butterfly is equally at home near the ground and in the tree tops, but it prefers to keep at least 10 feet above the ground. It may be seen flying about the branches of pines 30 feet in the air, or resting on a muddy spot in a road. If disturbed when on the ground or when resting on a leaf near the ground it will often fly high into the trees, and it is sometimes observed to flutter from the tree tops to the ground.

It is fond of sunning itself on the leaves of herbaceous plants or small bushes, and also on stones or on the ground. In the woods it is perhaps most frequently noticed on the trunks of pines or on exposed roots.

Its flight is slow and leisurely, rather fluttering, direct or with broad curves. If alarmed it is capable of considerable speed, in the open flying rapidly away a foot or so above the tops of the herbage, in the woods mounting gradually or abruptly to the tree tops. Fights between rival males are very lively, but are never prolonged.

On alighting the butterfly shifts its position several times, constantly moving the hind wings alternately up and down, before coming to rest. This habit makes it rather easy to detect.

It is less sluggish than *I. augustinus*, spending a larger portion of its time on the wing, and its flights are much longer. But it is almost equally stupid and unsuspicious and is very easily caught.

It is fond of flowers of various kinds, particularly the flowers of *Vaccinium* in the woods and of *Brassica*, *Antennaria*, *Gnaphalium*, and *Lupinus* in open fields. It is also sometimes seen on damp earth. When feeding on flowers it keeps its hind wings moving up and down.

Comparisons.—Local specimens are slightly larger than specimens from the vicinity of Boston. In a series of seven males taken at Paint Branch on April 29 and May 3, 1931, the fore wing measures 14–16 mm., averaging 14.5 mm., in length. In a single female taken at the same time the fore wing is 15 mm. long. Mr. Scudder gives 13 mm. as the average length of the fore wing in the male and 14 mm. in the female.

Specimens from the District are more richly colored than those from New England. They are darker above, usually dark slaty brown with bronzy and dark greenish reflections, and show two rather large brownish orange spots near the anal angle, which may be more or less obscured or obsolete. In the females the outer two-thirds of the wings, except for a moderately broad border, may be golden rusty, or the outer half of the fore wings alone may be dull rusty.

On the lower surface the ground color is darker than in northern specimens and is tinged with purplish. On the fore wings the submarginal row of small crescentic dark cinnamon spots seen in northern specimens is represented by a conspicuous scalloped black band; the irregular broken dark cinnamon band crossing the middle of the outer half of the wing is replaced by a rather broad continuous black band edged outwardly with white; and the two bands across the cell are black and heavy. On the hind wings the checkered pattern is conspicuously outlined in black, which is abruptly set off from the general ground color.

Doctor Holland's figure of the underside of this species shows a specimen about midway between the specimens from Boston at hand and those from the District, though nearer the former.

NOTE

In addition to the species of Theclinae given in the preceding pages, the following should be looked for in the District:

Strymon liparops (see p. 248).
Strymon edwardsii (see p. 249).
Strymon acadica (see p. 249).
Strymon cecrops (see p. 249).
Strymon favonius (see p. 249).
Atlides halesus (see p. 250).
Erora laeta (see p. 250).
Incisalia polios (see p. 250).
Incisalia mossi (see p. 250).

Family PAPILIONIDAE

KEY TO THE SUBFAMILIES

a^1. Fore legs with the tibia (outermost long joint or segment) bearing a leaf-like structure, the epiphysis, on the inner side; hind wings with broad tails; size large---- Papilioninae (p. 173).
a^2. Fore legs without an epiphysis; hind wings rounded, without tails; size medium; color white, yellow, or orange---- Pierinae (p. 147).

Subfamily PIERINAE

KEY TO THE SPECIES

a^1. Ground color above yellow or orange.
  b^1. Color above yellow.
    c^1. Entirely clear lemon-yellow with no dark markings (pl. 21, fig. 3)------------------------------------ Phoebis eubule (p. 163).
    c^2. Wings bordered with black.
      d^1. Black border of fore wings broader than that of hind wings.
        e^1. Expanse more than 38 mm.; hind wings above with a conspicuous yellow or orange spot just beyond the cell, below with a corresponding brown spot with a silver center (pl. 27, figs. 3–8)-------- Colias philodice (p. 158)

e^2. Expanse less than 38 mm.; no subcentral spot on the hind wings above or below (pl. 28, fig. 4) _ **Eurema lisa** (p. 149).

d^2. Black border of hind wings broader than that of fore wings (pl. 28, fig. 6) __________________ **Eurema nicippe** (p. 149).

b^2. Color above orange, or yellow with a more or less extensive orange flush.

c^1. Hind wings above with a conspicuous orange double spot just beyond the cell, and below with a corresponding double brown spot with a silver center; black border on hind wings always extending to near the anal angle and narrower than the black border on the fore wings (pl. 26, figs. 1–8) ______________________________ **Colias eurytheme** (p. 150).

c^2. Hind wings without a conspicuous spot near the center above or below; black border on hind wings broader than the black border on the fore wings, or reduced to a patch at the outer angle (pl. 28, fig. 6) ____ **Eurema nicippe** (p. 149).

a^2. Ground color above white.

b^1. Expanse more than 38 mm.; apex of fore wings rounded; hind wings not mottled with green beneath.

c^1. No orange spot near the center of the upper surface of the hind wings, which are not heavily bordered with black.

d^1. Fore wings tipped with dark gray, unspotted, or with a single dark spot beyond and below the end of the cell, or with this and another below it near the lower margin; hind wings unspotted, or with a dark gray spot on the anterior border just beneath the lower spot on the fore wing (pl. 28, figs. 1–3) ____________ **Pieris rapae** (p. 170).

d^2. Fore wings with a broad dark gray band across the end of the cell, otherwise almost unmarked, or with the anterior two-thirds of the outer margin broadly bordered with dark gray broken by large white triangles with their apices reaching the margin; hind wings unmarked, or with dark triangles at the ends of the veins which meet and fuse with a corresponding series of dark chevrons, forming a submarginal row of large rhombic white spots (pl. 29, figs. 5–8) ___ **Pieris protodice** (p. 166).

c^2. Hind wings with a conspicuous orange or yellow spot at the end of the cell; hind wings bordered with black; fore wings broadly bordered with black, the black border including a series of isolated white spots.

d^1. Spot at the end of the cell of the hind wings above chrome yellow to pale yellow; dark border of hind wings narrow, not including a row of white spots (pl. 27, figs. 5–8) _____________________ **Colias philodice** (p. 158).

d^2. Spot at the end of the cell of the hind wings above deep reddish orange; dark border of hind wings broad, inclosing, or partially inclosing, a row of large white spots (pl. 26, figs. 4, 8) ______________ **Colias eurytheme** (p. 150).

b^2. Expanse less than 38 mm.; apex of fore wings sharply pointed; hind wings mottled with green beneath; tip of fore wings orange (males) or white (females) (pl. 29, figs. 1–4).
Anthocharis genutia (p. 164).

Genus EUREMA Hübner

EUREMA NICIPPE NICIPPE (Cramer)

NICIPPE

Plate 28, Figure 6

Occurrence.—Local, and found only along the Potomac; frequent or even rather common on the flats below Chain Bridge and in low ground on the Virginia side of the river, and occasional in the meadows west of Cabin John, Md.

There are five specimens in the Schönborn collection, two dated July 16, 1888. Mr. Shoemaker reports it common on the Chain Bridge flats in July and also in September. I noticed it in some numbers on the Chain Bridge flats on June 30, 1923. I have specimens from Cabin John taken September 8, 1926, September 19 and 27, 1925, September 28, 1930, and October 14, 1923. Doctor Chapin has reported it flying about on December 12, 1900. It hibernates in the adult stage.

Notes.—In the Schönborn collection two of the five specimens, both taken on July 16, 1888, are clear brilliant yellow males.

In an unusually deep orange male taken on September 28, 1930, at Cabin John the fore wings are tipped with a heavy dusting of yellow scales and the fringe is bright orange; the ground color of the wings beneath is a clear yellow-orange.

EUREMA LISA (Boisduval and Le Conte)

LISA; LESSER SULPHUR

Plate 28, Figure 4

Occurrence.—Abundant in fields and along roadsides wherever the partridge-pea (*Chamaecrista chamaecrista*) is common. It is most numerous in the fields along the canal to beyond Cabin John and on dry hillsides in Rock Creek Park, at Silver Spring, and elsewhere. In meadows or pastures with a luxuriant growth of long grass or of tall clover it is usually only casual.

Habits.—The lisa has a curious errant flight, progressing in a broad irregular zigzag, the direction of which it changes frequently. It keeps about 6 inches above the ground or above the grass tops, and the straight portions of its flight, which combined make up the zigzag, when viewed from the side are seen to be low arcs. There is therefore a suggestion of that skipping so characteristic of our satyrids and of the tailed blue. It is a very active little butterfly, and on sunny days is almost constantly on the wing, though it rests from time to time.

The lisa is fond of flowers, especially of yellow flowers such as those of the goldenrod. Whenever possible it prefers to rest on yellowed or whitened leaves. The males are very fond of sucking moisture from mud, which they do in little compact companies of from 4 to a dozen or more, sometimes as many as 20. There may be several companies on a single muddy spot. Usually these companies include more or fewer of the males of the yellow clover (*Colias philodice*), the relative proportions of the two being roughly the same as in the near-by fields. On a muddy spot they will at once collect about a dead yellow butterfly, or even about a bit of yellow paper.

This butterfly occasionally migrates in immense swarms, but no such phenomenon has been reported from the District.

Season.—The lisa appears just before the middle of May in small numbers and continues to emerge throughout June. Its numbers increase during summer, and after the first of August it is very common. Still increasing in abundance, it reaches its maximum about the middle of September and continues abundant until the cold weather puts a stop to its activities. Fresh individuals are found continually from its first appearance.

Notes.—About Washington as elsewhere the lisa varies considerably in color. The males range from pale to deep yellow, sometimes tinged with chrome. The females range from light yellow to a slightly yellowish white. The size is also variable. The largest female at hand has the fore wings 21.5 mm. in length, and the largest males are of equal size. On the other hand, dwarfs of both sexes are not uncommon.

A curious male taken at Cabin John on September 11, 1928, has the apex of the fore wings broadly rounded off so that the costal border is scarcely longer than the lower border; the outer border is convex and the wings are broadest just below the middle of the outer border.

Remarks.—The only pupa of this butterfly which I have seen in its natural position was found by Hugh Clark on the stem of a pigweed (*Chenopodium album*) about an inch above the ground.

In a series of 20 males taken on October 6 and 7, 1928, the length of the fore wing was 14–20 mm., averaging 19 mm.; 4 females had the fore wing 17–20 mm., averaging 19 mm., in length.

Genus COLIAS Fabricius

COLIAS EURYTHEME (Boisduval)

ORANGE CLOVER

Plate 26, Figures 1 to 8

Colias eurytheme LUGGER, Proc. Ent. Soc. Washington, vol. 1, no. 2, p. 61, 1888.

Occurrence.—Abundant throughout the District and the surrounding country, being found in all open fields and meadows. It is frequent in the city parks, and occasionally strays into the business section of Washington.

History.—Until a very few years ago this was a rare butterfly in this region. It was first mentioned as occurring in Washington in 1888, when Otto Lugger published a short note saying that he had seen an example of "*eurytheme*, or rather a very pale variety of it, looking like *Pieris*," flying about some flowers of dandelion in the Department of Agriculture grounds on November 11, 1886. It is somewhat difficult to say just what this form of the species could have been, but it would seem that it must have been one of the white females slightly tinged with pink on the discal portion of the fore wings and with yellow on the hind wings. Only a white female could be compared with a species of *Pieris*, and the usual white female could not be distinguished with certainty from the white female of *C. philodice* unless it were caught and closely examined.

There is a single broken male of the form *amphidusa* without date from the District in the Schönborn collection. In view of the fact that Mr. Schönborn kept only a very small series of perfect specimens this would indicate that he found it rare. The National Museum contains a male of the form *ariadne* taken in the District on September 6, 1904, by C. R. Ely, and I have seen a male of the form *amphidusa* taken in the District about 1910 and subsequently mounted in a tea tray.

I have a single female taken just across the Military Road from Rock Creek Park by Austin B. J. Clark on September 24, 1923.

In 1925 this butterfly was occasional in the meadows west of Cabin John, whence I have specimens, all females, dated September 11, 19, and 27 and October 11. The greatest number seen in any one day was three. A particularly fine white female was captured on September 19.

In 1926 this species was much more numerous, particularly in the higher regions to the northwest of the District, and some unusually fine males were captured. Specimens were taken on August 27, and on September 8 and 9. On September 8 no less than seven were caught, and about as many more were seen but not captured. In this year it was noticed in the Smithsonian Institution grounds on September 18 and 20 and on October 11 and 13.

In 1927 it was exceedingly abundant from the middle of July until the end of the season. In the higher and more exposed areas, as about Silver Spring and Somerset, Md., its numbers were equal to more than half the numbers of the yellow clover (*Colias philodice*) when the latter was at its maximum. Indeed, on some days there seemed to be no difference in the frequency of the two species. It was common in the Smithsonian and Department of Agriculture grounds, and was occasionally seen throughout the city. Ernest Shoemaker wrote me that he found it very common on the Eastern Branch from September 19 to 25, and this was the first season he had taken it in nearly 50 years' collecting.

In 1928 it was first taken on June 24 and was very common from the first of July onward, although in this year it was considerably less abundant than in 1927. Its numbers were equal to one-third or one-fourth the numbers of *C. philodice.* On October 6 and 7 a careful count was made at Cabin John, and it was found to be just one-fifth as numerous as *C. philodice.*

In 1929 it was taken as early as May 12, when two males were seen and one captured. It disappeared in the last week in May, but fresh individuals appeared in the second week in June. By the end of June it had become abundant, and it remained abundant, its numbers being, in some places at least, equal to the numbers of *C. philodice.*

In 1930 it was noticed on April 27, and both sexes were common on May 4, when they outnumbered the corresponding sexes of *C. philodice.* It disappeared toward the end of May, but reappeared in the middle of the second week in June when a male was seen at the intersection of Seventh Street and Constitution Avenue. At the end of the summer it far outnumbered *C. philodice.*

Summing up the history of this butterfly in the District, we may say that prior to 1926 it occurred only in very small numbers late in summer and in autumn. The earliest recorded date is September 6, and most of the individuals were taken or seen after the middle of September. This would indicate that the individuals found in the District were the young of a few intruders of the midsummer brood. In 1926 it was for the first time numerous. It was first taken on August 27. Apparently in this year a large number of the young of the intruders survived. But the intruders could not have been very many, as none were seen in the course of very intensive combing of the fields in July. In 1927 and 1928 it appeared in June and early in July. In this year the earliest individuals were evidently the young of intruders of the spring brood, the later individuals in this year representing a second instead of a first local generation. In 1929 and 1930 it appeared late in April and early in May. As the earliest examples were perfectly fresh they could not have come in from outside, but must have hibernated here, the species having now become a permanent resident.

Whether it will continue as a permanent resident, or will decrease to its former status as a rather scarce late-summer intruder, or will eventually entirely disappear, remains to be seen.

Entry into the District.—The entry of this butterfly into the District is simply the local phase of its extension into the region east of the Appalachians. Mr. Scudder wrote in 1889 that "east of the Mississippi Valley it occurs sparingly and disappears entirely at the Alleghenies with the few exceptions which we shall shortly note." Further on he said that it had occasionally appeared east of the Alleghenies, and listed the records. There was a single record for Maryland, and it had been recorded at Newcastle, Del., and by Abbot in Georgia. There were several records for New England, most of them in the southern portion, but one from Bangor, Me. (See A. H. Clark, Psyche, vol. 35, no. 4, p. 226, 1928.)

When W. H. Edwards was living at Coalburg, in the Kanawha Valley, in southern West Virginia, this butterfly was entirely unknown in that region.

In March, 1907 (Entomological News, vol. 18, no. 3, p. 97), C. S. Brimley and Franklin Sherman, jr., wrote that it occurred in North Carolina from the east-central portion (Raleigh) westward, flying from the end of March to the end of October, while *C. philodice* was generally distributed and abundant in the mountains, flying from March to November. In a recent letter Mr. Brimley tells me that *C. eurytheme* is common all over the State, and has been ever since he began keeping records in 1900. He finds it hard, however, to discriminate from *C. philodice* at times, and notes that while there are more records of the latter, the North Carolina Department of Agriculture has far more specimens of the former.

So far as the records show this butterfly was unknown in North Carolina up to 1889, but it was common in 1900. In 1929 Hugh U. Clark and I found it common in the Greenbrier, New River, and Kanawha Valleys, in southern West Virginia, where it did not occur in Mr. Edwards's time. In the spring of 1929 it was not very common in the District, but Austin B. J. Clark found it abundant on April 21 at Lexington, Rockbridge County, Va., and southwestward. Here it was much more numerous than *C. philodice*, though northeast of Lexington *C. philodice* was much more numerous than *C. eurytheme.*

Summing up the evidence, we may say that before 1889 *C. eurytheme* did not occur in the mountains or on the Atlantic watershed. But during the next 10 years it filtered through the mountain valleys and became common in North Carolina and southern Virginia. Sometime before 1895 stragglers began to reach the District, apparently from the southwest. Here it remained as a rather rare butterfly occurring only late in summer until 1926, when it increased in numbers and, continuing to increase in subsequent years, it became an abundant permanent resident in 1929.

Additional notes.—On August 25, 1925, at Ipswich, Mass., we captured three fresh males of this species and saw two other individuals, and on August 30, 1925, we met with another at Essex, Mass.

(Psyche, vol. 32, no. 6, p. 297, December, 1925). On August 25, 1930, in a meadow at Newton Upper Falls, Mass., near Boston, we saw a female and a large and a small male, and also two others in the distance. On August 27 another was seen in the same place, but on several subsequent visits none were seen. On September 3 one was seen, among many *C. philodice*, in a clover field at Charles River. On August 28 the locality at Ipswich where we had found this butterfly in 1925 was revisited, and it was again found. On a trip from Boston to Washington by way of the Delaware Water Gap and Easton and Reading, Pa., this species was not seen until we were a few miles south of Reading, when occasional stray individuals were observed. But it was not at all common north of Baltimore.

Seasons.—The orange clover butterfly first appears toward the end of April, the males several days in advance of the females, and soon becomes common, remaining on the wing until the last week in May. Early in the second week in June the second brood appears, and from that time on fresh individuals are seen continually until the end of the season. In the last two weeks in July most of the individuals are worn and faded, although fresh ones are always to be found. About the first of August fresh butterflies begin to increase greatly in numbers and to assume a somewhat different character, this advent of fresh individuals representing the appearance of the third brood. The butterfly is most abundant in the last half of August and the first half of September. Fresh individuals are common until toward the end of October and appear on warm days until late in November.

Habits.—This butterfly closely resembles its yellow relative (*Colias philodice*) in habits, but the large males have a higher and swifter flight and are much more wary and difficult of approach. They course rapidly about in a broad zigzag with frequent changes of direction, usually 2 or 3 feet above the ground or grass tops. Males of decreasing size show a corresponding approach to the habits of the males of *C. philodice*, flying lower and less swiftly and in a narrower zigzag composed of shorter lines; the habits of the very small males only slightly flushed with orange on the disk of the fore wings (*ariadne*) are indistinguishable from those of the males of *C. philodice*. Furthermore, these males prefer the company of the males of *C. philodice* to that of the large and highly colored males of their own kind. They are sometimes to be found in the little companies of the males of *C. philodice* sucking moisture from mud. When so engaged their actions differ in no way from the actions of their companions, from which they are indistinguishable until they rise and by so doing display the slight orange flush on the fore wings. It is curious that while the small males of the form *ariadne* are as fond of sucking moisture from mud as the males of *C. philodice*, the larger males of the forms *keewaydin* and *amphidusa* are, at least in this region, never seen on mud.

The females are less active than the males and their flight is more irregular, somewhat less fast, and lower, not far above the grass tops. Their flight is never very long, seldom more than 100 feet. They are not shy, even the largest of them, and when once seen they may always be caught unless they have been very badly frightened.

A female with a male fluttering about her will sometimes rise to a height of more than 100 feet above the ground.

Both sexes are very fond of flowers, especially of the flowers of the red clover (*Trifolium pratense*). They are also occasionally to be seen on the flowers of the buttonbush (*Cephalanthus occidentalis*) and later on the thistles and other tall composites.

The large and brightly colored males pay little or no attention to the females of *C. philodice*, but the small males, and especially the light colored ones, are very attentive to them. The males of *C. philodice* are very attentive to the smaller females of *C. eurytheme*, which sometimes respond to them in the same way as their own females. But I have never found examples of the two species mated.

In all the mated pairs of *C. eurytheme* that I have found the two individuals have always been of precisely the same form, *ariadne*, *keewaydin*, or *amphidusa*. Males of the form *amphidusa* are occasionally found mated with white females, but I have never seen males of the other two forms mated with white females.

I have found females of this species depositing eggs on the common red clover (*Trifolium pratense*) and also on white sweetclover (*Melilotus alba*).

Sequence of forms.—In northern Texas, as described by Boll, the first individuals of this species to appear are of the form *ariadne*. The butterflies of the next brood are much larger, and are of the form *keewaydin*. Those of the next two broods are large and deeply colored *eurytheme*. These last represent the wet form of the species, *keewaydin* represents an intermediate form, and *ariadne* represents a dry form.

In the District the butterflies of the spring brood all appear to be referable to the form *keewaydin*. They are usually of a moderately intense orange, which on the fore wings shades off into clear yellow toward the anterior half of the black border. The males are rather pale, and the violet reflections are wholly absent, or if present are very faint. Usually in the females that portion of the fore wings anterior to vein M_2 and beyond the outer portion of the cell is yellow, forming a noticeable yellow patch, and the yellow is often continued proximally to the inner margin of the wing as a narrow and more or less indefinite band between the black outer margin and the orange ground color. There is some variation in the depth of the orange, and considerable variation in the extent of the yellow, but so far as I have seen the yellow is always present. The size of the spring butterflies is quite uniform, and they are scarcely larger than the representatives of *C. philodice* with which they fly.

This form, which is more intensely colored than typical *keewaydin* and which I previously regarded as rather pale *eurytheme*, persists throughout the summer, and is at all times the most abundant form.

The early individuals of the second brood, appearing early in June, resemble the butterflies of the spring brood. After the first of July very light individuals of the form *keewaydin* appear, flying with the others, and by the middle of July these have become common; they remain common until the end of the season. In the last week in July the small dry form *ariadne* appears and slowly increases in numbers until the end of the season, though it is never very numerous.

After the first of August the males are for the most part somewhat darker than the males that occurred earlier in the summer, and usually show pronounced violet reflections, which in a few are very brilliant in life. Many of the females are also somewhat darker than those found earlier in the summer, and are uniform orange over the entire fore wings within the black border and over the light area of the hind wings, including the submarginal spots more or less inclosed within the dark border. In boggy pastures near the river the females frequently reach a very large size. This deep orange form, which becomes common after the first of August and increasingly common to the end of the season, I take to represent typical *eurytheme.*

In 1930 the rather deeply colored *keewaydin* form was the only one met with throughout the season. If the others occurred at all they must have been very scarce.

Remarks.—The typical light *keewaydin* and the typical dark *eurytheme*, which are of the same size, seem to intergrade to a considerable extent, but the small *ariadne*, while rather variable, is more distinct, though specimens are sometimes found which might be considered as intergrades between this and the light *keewaydin.* The light and small *ariadne*, however, is often distinguishable from *C. philodice* only with the greatest difficulty, particularly in the case of the females. Indeed, it seems to intergrade completely with *C. philodice* in this region. From the evidence at hand it would seem that intergradation between *ariadne* and *philodice*, which have the same habits, is as complete as the intergradation between *keewaydin* and *eurytheme*, which also have the same habits, their habits differing from the habits of the other pair.

White females of the form *eurytheme* are fairly common. White females of the form *keewaydin* occur, but are infrequent. No white females definitely determinable as belonging to the form *ariadne* have been found. These would be almost indistinguishable from the abundant and very variable white females of *C. philodice.* White females occur in early spring as well as throughout the summer.

A white female taken at Cabin John on October 7, 1928 (pl. 26, fig. 8), has on the fore wings beneath the cell a faint flush of salmon-pink fading to white near the black border, while the hind wings are tinged with greenish yellow. As the salmon flush on the fore wings covers the area that is orange in the form *keewaydin*, it is evident that this white female must be referred to that form. A similar white female was taken at Cabin John on September 7, 1929, and a third at the same place in October of the same year. Others were taken on September 17 and 19, 1930. This type of female has not heretofore been reported.

A chrome-yellow male of the form *eurytheme* was taken at Cabin John on September 23, 1928.

In a white female taken at Cabin John on September 19, 1925, the basal third of the costal border of the fore wings, the hairs on the anterior portion of the dorsal surface of the thorax and on the head, the hairs on the central portion of the thorax below, and the legs, are bright pink. The basal portion of the fore wings as far as a line at right angles to the inner border and passing through the origin of vein M_1 is heavily infuscated. The ground color of the hind wings and of the lower part of the base of the fore wings is light grayish green.

In a male of the form *ariadne* taken at Cabin John on September 22, 1928, the size, wing shape, and markings are as in small males of *C. philodice.* The fore wings have a faint orange flush in the lower half, and the hind wings are scarcely tinged with orange. The subcentral spot on the upper surface of the hind wings is a rather pale orange.

In a female of the form *ariadne* taken at Cabin John on September 14, 1928, the yellow spots in the black border of the fore wings are greatly reduced. The black cell spot on the fore wings and the dark border of the hind wings are as in the form *eurytheme.* The lower half of the fore wings shows a very faint flush of orange. The color of the hind wings is scarcely intensified.

Measurements.—Specimens taken up to the last week in July measure in the length of the fore wing: Males, 24–27 mm., averaging 25.5 mm.; and females, 25–29 mm., averaging 27.5 mm.

Specimens taken from the last week in July to the end of the season measure: 31 males, 25–31 mm., averaging 27.3 mm.; and 55 females, 25–34 mm., averaging 29.1 mm.

Of the form *ariadne* the males measure 23–26 mm., averaging 25 mm., and the females 27–28 mm., averaging 27.5 mm.

Unusually large specimens were captured on the following dates: Males with the fore wing 29 mm. long, August 6, 1927, and September 14, 1928; with the fore wing 30 mm. long, September 8, 1926; with the fore wing 31 mm. long, October 7, 1928. Females with the fore wing 32 mm. long, August 6 and 13, 1927; with the fore wing 33 mm. long, August 6, 1927, and October 6, 1928; with the fore wing 34 mm. long, September 11 and 14, 1928.

COLIAS PHILODICE (Godart)

YELLOW CLOVER

Plate 27, Figures 3 to 8

Occurrence.—Abundant and generally distributed throughout the District. It is, or rather was until 1930, the most numerous of the medium-sized butterflies.

The yellow clover butterfly is found everywhere in open country, and is particularly abundant in fields with a luxuriant growth of clover.

There is a single male from the District in the National Museum taken in 1915. The Schönborn collection includes six specimens, two males, two yellow females, one lacking the spots in the black border of the fore wings, and two white females, one with a yellowish tinge.

Habits.—On warm and sunny days the yellow clover is a rather active butterfly, coursing about the fields usually about a foot above the grass tops in a broad irregular zigzag the general direction of which often changes suddenly. From time to time it rests upon a flower, and when feeding is as a rule quite unsuspicious. The larger males have a higher, faster, and stronger flight than the smaller ones. They are also shier, and are sometimes rather difficult to capture. The females are less active than the males; their flight is less irregular, usually lower, and never very long.

When two males meet they may flutter about each other for a second or two and then continue on their way, or they may engage in combat, gradually rising vertically to a height of sometimes 50 feet or more.

When a male and female meet the female may alight upon a leaf, spread her wings almost to the full, the hind wings being more nearly horizontal than the front wings, and constantly flutter them with a tremulous motion, while the male actively flutters about her, in front and on either side; or the female may rise rather slowly upward at a steep angle with the male, as noticed by Mr. Scudder, just above or in advance of her. A pair may rise in this way, according to Mr. Scudder, for 50 feet or more, though usually they rise to between 10 and 15 feet. The performance ends by the male suddenly descending, the female then coming down more leisurely and in a different direction. Often a rising pair will be joined by a second male and sometimes by a third or even by a fourth, so that four or five butterflies are fluttering about together. In this case the female never rises for more than about 10 feet.

In mated pairs the male always carries the female in flight. I once caught a white female that was carrying a yellow male. But on examination the male proved to be dead, probably having been killed by a phymatid bug or a crab spider.

This butterfly is very fond of flowers, and its preference for yellow flowers often has been noticed. It prefers to feed on flowers at about the level of the grass tops. In this region the butterflyweed (*Asclepias tuberosa*) provides the flowers seemingly most attractive, and in a grassy field a dozen or more may be seen upon a single plant in company with as many pearl crescents (*Phyciodes tharos*) and a few tailed blues (*Everes comyntas*). Red clover is the flower next preferred, and after that the flowers of small leguminous plants in general. Late in summer it is fond of the flowers of the goldenrod, of the thistles, and of the asters, though preferring the flowers of small leguminous plants if it can find them.

If a cloud obscures the sun these butterflies at once seek a place to rest. Their first choice is a yellowed clover leaf, or a yellowed leaf of any kind. In gardens they are very partial to yellowed leaves on privet hedges.

The males are particularly fond of sucking moisture from mud, and on muddy places they gather in little companies of from 3 or 4 to a dozen or 15 or more. Almost invariably these companies include more or fewer of the lisa (*Eurema lisa*), which sometimes are in the majority.

Like all the social mud-loving pierids, the yellow clover butterfly is easily decoyed by dropping dead butterflies or even bits of yellow paper on the mud.

The males of this species are very attentive to the smaller females of the orange clover (*Colias eurytheme*), though the orange males take little notice of the yellow females. Occasionally the males of the two species will flutter about each other for an instant, though they soon separate.

Seasons.—The yellow clover butterfly appears usually shortly before the middle of April and becomes common in the last half of the month and in the first half of May, but the individuals in the first brood are never very numerous. In the last half of May the butterflies become very scarce and all the individuals are worn; they disappear entirely before the end of the month. Early in the second week in June occasional fresh males are seen, which mark the advent of a new brood; by the middle of the month they have become common, and fresh females appear. They do not become abundant, however, until the last week in June, when, usually shortly before the first of July, their numbers suddenly increase. The butterflies continue abundant into early August, when fresh individuals again grow scarce. Just before the middle of August males of the third brood appear, flying with the still numerous individuals of the second brood. The third brood becomes exceedingly abundant at the last of August and in the first week in September, and continues to fly in numbers, with the constant addition of fresh individuals, until at least about the middle and usually about the end of October.

Notes.—The early-spring females at hand are all very small, with the fore wings only 24 or 25 mm. in length. In most of them the dark border of the hind wings is narrow with a slightly scalloped inner border, which in some shows a slight tendency to continue inward along the anterior veins. It may terminate just after vein M_3, or it may be continued somewhat farther. In a white female taken in April it is rather broad and is continued as a haze of dark scales almost to the anal angle. The dark border on the fore wings is narrow, the portion below vein M_3 being about as wide as the cell, with the included spots separated from the yellow of the wing only by a fine hazy line, or sometimes not at all. In two white females this border is somewhat broader and the apical portion is extended inward for about two-thirds of the distance from the apex to the black spot, while the included spots are much reduced in size. A yellow female also has the apical portion of the border extended inward in the same way and the included spots much reduced. In this individual the black spot at the end of the cell has a conspicuous yellow center.

In these early individuals the hind wings are broadly and evenly rounded, and the fore wings are rather short with the outer border always more or less convex and the apex well rounded.

The later individuals of this brood are larger than the earlier and resemble the individuals of the brood following.

The males of the second brood vary very little. Most of the variation is in the shape of the hind wings, the relative development of the broadly rounded angle at the end of the upper radial, which may be wholly wanting, and the relative development of the anal angle, which occasionally is so very broadly rounded as to be almost absent. From time to time enormous individuals, abruptly larger than the largest ordinarily found, are seen. These are wary and very strong fliers and act more like the males of *C. eurytheme* than like the smaller males of their own species. They seem to be representatives of the form occurring in the Mississippi Valley and in the valleys of West Virginia and western Virginia.

The females are more variable than the males. Although as a rule the hind wings of the females are broader and more evenly rounded than those of the males, they occasionally have the same form, or perhaps more correctly the form of the hind wings seen in the female of *Zerene caesonia*, with a well-developed rounded angle at the end of the upper radial and a well-developed rounded anal angle. The angle between the inner and outer border of the fore wings is ordinarily obtuse, somewhat less so than in the male, more rarely a right angle. Rarely females have the hind wings broadly and evenly rounded and the fore wings rather strongly convex on the outer margin.

The black border on the fore wings is usually heavy, the black extending inward for two-thirds of the distance from the apex of the wings to the cell spot. The spots within this border are very variable in size. Occasionally they are wholly absent, the margin of the wing both in the yellow and in the white form being solid black. Sometimes the black border is narrow and of uniform width, not broadening toward the apex, so that it extends less than half the distance from the apex to the black spot. The border of the hind wings is very variable, though usually broad and rather heavy. Its upper portion may inclose a rather large rounded yellow (or white) spot, and sometimes it may more or less completely inclose another below it; usually the first of these is more or less definitely indicated. Beneath these spots the dark scaling usually runs up the veins in a short tooth, more rarely the inner border of the black margin is smooth. Occasionally the margin is reduced to a series of curved triangles with their broad bases, which are separated from one another by narrow yellow (or white) lines, situated on the margin of the wing and their produced and attenuated inner apices running inward along the veins. In extreme cases the bases of the triangles may be very narrow and widely separated and the black may run for a long distance inward along the veins, especially the two uppermost, as a black line. When the black on the fore wings is much reduced there may be simply a light dusting of dark scales on the ends of the four anterior veins. In some individuals, both yellow and white, the base of the fore wings as far as a line at right angles to the inner border passing through the origin of vein M_1 is very heavily dusted with deep olive (in the yellow individuals) or dark gray (in the white) scales, and similar scales are also abundant on the abdominal half of the hind wings, especially toward the base.

In both sexes there is great variation in the color of the spot at the end of the cell in the hind wings. It is usually bright orange, but is sometimes so pale as scarcely to be distinguished against the ground color of the wings, or it may be deep reddish orange, almost as bright as in *C. eurytheme.* In the white female it varies from pale straw yellow to bright red-orange.

There is also much variation in the black spot at the end of the cell on the fore wings. This is usually about twice as long as broad in the males and from one-half to one-third again as long as broad in the females. In both sexes it often bears a prominent tooth in the middle of the apical side. In the males it is sometimes reduced to a narrow black line, and in the females rather frequently and in the males occasionally it has a conspicuous yellow (or white) center.

White females frequently are flushed with yellow on the hind wings from the abdominal border as far as the cell and vein M_1, where the yellow abruptly ends and also, less strongly, in the corresponding area on the fore wings. In some cases this yellow is bright and very conspicuous. In all such specimens which I have seen the hind wings are shaped like the hind wings of *Zerene caesonia*, and the outer margin of the fore wings is nearly at right angles to the inner, while the black margin of the hind wings is reduced and resembles that in *Z. caesonia.*

Rarely females occur which are deep, almost chrome, yellow on the fore wings and have a pronounced orange flush on the hind wings. One such female was taken at Silver Spring, Md., on August 6, 1927. On the wing it was mistaken for *C. eurytheme* form *ariadne.* This might possibly be considered as a hybrid with *C. eurytheme* were it not that I have an exactly similar female, somewhat larger and with larger spots in the black margin of the fore wings, taken at Newtonville, Mass., a locality where *C. eurytheme* is unknown or at least an extremely rare casual, on July 25, 1923.

Males are not infrequently taken late in summer that have a slight orange flush along the submedian vein and vein M_1 on the fore wing.

The individuals of the third brood seem not to differ from those of the second brood.

It is worthy of special note that in this region white females are relatively as common early in spring as later in the season, appearing with the earliest yellow females of the spring brood. They occur in the spring, however, in only one form, a white replica of the corresponding yellow females. In eastern Massachusetts white females do not occur in the spring brood.

Measurements.—Specimens taken up to the middle of July measure in the length of the fore wing: Males 24–29 mm., averaging 26.0 mm., and females 24–29 mm., averaging 25.7 mm.

Specimens taken from the middle of July to the end of the season measure: 63 males, 24–31 mm., averaging 26.1 mm., and 57 females 24–31 mm., averaging 27.9 mm.

Genus PHOEBIS Hübner

PHOEBIS EUBULE EUBULE (Linnaeus)

Giant, or Cloudless, Sulphur; Eubule

Plate 21, Figure 3

Occurrence.—Casual late in summer, appearing in limited numbers nearly every year and occasionally rather frequent in the lowlands near the river and the Eastern Branch.

There are four specimens from the District in the Schönborn collection. Mr. Shoemaker has a specimen which he took in Arlington County, Va., above the Free Bridge, on September 21, 1919, and two taken at Licking Bank, Eastern Branch, on September 18, 1921, while they were feeding on some refuse matter near the water. I saw three on different days in September, 1907, fly across the Smithsonian Institution grounds, and three in September, 1921, in the same place. I saw one in the fields beyond Cabin John on September 6, 1926, another in same place two days later, and a third by the side of Conduit Road at the bottom of the western side of the hill just over the Maryland line on the latter date. Two were seen along the canal just beyond Cabin John on September 7, 1929.

This butterfly is common all along the western shore of Chesapeake Bay, extending inland to the valley of the Patuxent and the lowlands of Howard, Carroll, and Frederick Counties north of Washington. It is also common about the lower Potomac and is frequent as near the District as Alexandria and Falls Church, Va.

All the individuals captured or seen in the District with a single exception have been males. On September 7, 1929, Hugh U. Clark saw a female at close range by the side of the canal at Cabin John, but was not able to catch it. He is thoroughly familiar with this butterfly, having seen it in large numbers in Florida, Georgia, South and North Carolina, and along Chesapeake Bay in Maryland, and having caught the females in Florida and Maryland, so that there can be no doubt of the correctness of his record.

While this memoir was in press the preceding observation was confirmed by his capture of a female at Silver Spring, on September 14, 1931. This is the only individual that has been reported from this locality. It was found flopping about on the main road, having been struck by a passing automobile. There is, of course, a possibility that it had been picked up some distance away and simply dropped there.

Habits.—The giant sulphur has a swift and very erratic flight, this way and that and more or less up and down. It is extremely restless and energetic and seldom pauses. It usually travels at a height of 3 or 4 feet above the ground, but when passing through groves of trees fringing the banks of streams it may zigzag up to a height of 20 or 30 feet or more.

The females are easily distinguishable from the males when on the wing by the difference in color and by their less energetic and less erratic flight. They also pause more frequently to feed.

The flight of both sexes of this butterfly is of quite the same nature as that of the corresponding sexes of the yellow clover (*Colias philodice*), differing only in the greater speed and strength. Unless one is well acquainted with it, this butterfly is not always easy to distinguish on the wing from the very large males of the yellow clover, which are occasionally found here in the late summer.

In the District the giant sulphur is wary and suspicious. It is usually seen coursing rapidly along in a slightly zigzag or almost straight line 5 or 6 feet above the ground. If there is any movement of the air it always flies against the wind. More rarely it is seen quartering the fields as it does in the regions permanently inhabited by it. This indicates that the majority of the individuals seen here are strays or migrants.

Like many other butterflies, especially other pierids, the giant sulphur seems to acquire a feeling of confidence with increase in numbers, for where it is abundant it is as a rule not at all shy, though easily frightened.

It is very fond of flowers, especially yellow flowers, and also of carrion and filth, and when feeding it is quite unsuspicious. It is also fond of sucking moisture from mud, and where it is common large companies are sometimes seen sitting quietly on muddy spots.

Like its relatives in South America and in the Tropics of the Old World, it is very easily decoyed by imitation butterflies cut out of yellow paper and set up in muddy spots. In Tennessee I have caught it in quantities by the use of such decoys.

Genus ANTHOCHARIS Boisduval

ANTHOCHARIS GENUTIA (Fabricius)

Orange Tip

Plate 29, Figures 1 to 4

Occurrence.—Frequent, but never very common, in moist open deciduous woods. It is most numerous in the woods along Paint Branch, and is also found in some numbers in the woods along the river and the canal, in portions of Rock Creek Park, and elsewhere. At the height of the season from 5 to 10 may be taken in a day in the localities where it is most common.

The Schönborn collection contains four males, four females, and a pupa. The males were taken April 18 and 20, and the females

April 18 and 28. There are seven specimens from this region in the National Museum. Of 4 males, 2 are labeled Cabin John, April, 1919 (D. H. Blake); 1, District of Columbia, April 27, 1885 (Schönborn); and 1, Washington (W. Schaus). One female is labeled April 21 (Schönborn) and another is labeled April, 1899. Mr. Shoemaker has specimens taken the last of April and first of May in Rock Creek Park and in Arlington County, Va.

Habits.—The orange tip, in marked contrast to all our other pierids, is a woodland butterfly, keeping mostly among the trees, though it is rather fond of flitting across open glades and for short distances along the sides of woodland roads. While it is frequently seen just at the border of woods, it will not venture out over open fields.

It is a very active little butterfly, and is seldom seen except upon the wing. It flies in cool weather and also on cloudy days when the other spring pierids are wholly inactive. It seems to pay little attention to flowers.

The orange tip flies about 2 feet above the ground with the wings moving rapidly through a small arc, which gives the flight a peculiar tremulous or fluttering aspect. The course is a slight and somewhat irregular zigzag, much more marked in the males than in the females. When the insect is alarmed the speed is much increased and the zigzag becomes more pronounced, while the butterfly usually rises to a height of about 3 feet, or occasionally more. The flight of the orange tip much resembles that of *Pieris protodice*, and in spring it is possible to confuse the two when seen on the wing.

Season.—The orange tip first appears in the last week in March, and in a few days the males become common. The females appear about a week later than the males, or in the first week of April. Toward the end of April the females become numerous, and in the first week in May they outnumber the males. By the end of the first week in May only a few females are to be seen, and during the second week in May the last of them disappear.

In both sexes there is a regular progressive increase in size from the earliest to the latest individuals.

Notes.—Mr. Schönborn was the first to work out the life history of this butterfly. In 1886 he supplied Mrs. Mary Peart with the eggs, larvae, and food plant, from which material she prepared the illustrations published by W. H. Edwards. Later, in 1888, he sent eggs and plants directly to Mr. Edwards. He wrote to Mr. Edwards:

> I never found a larva in open fields, although the plant grows there in abundance in large patches. I always found them on isolated plants growing in places sparingly covered by large oaks, hickories, cedars, and other trees.
>
> After the plant has gone to seed it utterly disappears, and the larvae never pupate on the plants, but go to the trunks of the nearest trees and there change

in the cracks of the bark, or other protected places. The color of the pupa is such that on an oak it would be almost indistinguishable.

The food plant referred to is *Sisymbrium thalianum;* but Mr. Schönborn also found the eggs on the common wintercress (*Barbarea vulgaris*). He never found more than one egg on a plant.

In the females the apical portion of the fore wings in the area which in the males is orange is sometimes distinctly grayish and rarely a more or less bright yellow. I have a female taken in the woods along Paint Branch on April 29, 1931, in which the wing tips are bright yellow.

Genus PIERIS Schrank

PIERIS PROTODICE (Boisduval and Le Conte)

CHECKERED WHITE

Plate 29, Figures 5 to 8

Occurrence.—Formerly abundant, but now only of casual and irregular occurrence. As this butterfly is often very local, it is possible that it may occur permanently in small numbers in some very limited area or areas within or very near the District. I have seen and taken it on the shores of Chesapeake Bay in Maryland in years when it was not found in the District.

Dr. L. O. Howard writes me that he never saw this species before he came to Washington in November, 1878. In the summer of 1879 he noticed it very frequently around Washington. In a note in Insect Life published in November, 1892 (vol. 5, no. 2, p. 99) he said that about Washington "both the native and imported species of *Pieris* are very destructive to Cabbage." In July, 1892, in company with Dr. E. A. Schwarz, he had been investigating cabbage worms on Col. John Rives's farm at Rives Station, Md., a station on the Baltimore & Ohio Railroad 9 or 10 miles from Washington, and this note was published in connection with his observations at that time.

Since then this butterfly has almost completely disappeared from this region, having been unable here as elsewhere to compete with the European *P. rapae.*

There are two specimens, a male and a female without dates, in the Schönborn collection, and the National Museum contains two females, one taken in Washington on August 2, 1906 (I. J. Condit), and the other taken on July 18, 1919.

In 1926 I took this species in the meadows beyond Cabin John on September 6, saw it on September 13 in the same place, and noticed it in the Smithsonian Institution grounds on September 10. In the same month one was reported from the street in front of the Central

High School in Washington (A. B. J. Clark), and another was captured in the National Zoological Park (H. U. Clark).

There are no records from this time until 1930, when Hugh Upham Clark captured a female in Rock Creek Park on September 16, and I took a male in the meadows beyond Cabin John on October 15.

On April 29, 1931, when with Dr. and Mrs. Torsten Gislén and Miss Doris M. Cochran, I saw two individuals along the border of an open field near the lowest of the Paint Branch bogs. Returning to the same place with Hugh Upham Clark on May 3, I saw five more, of which two, both females, were caught. A male was captured here on May 9. In this field the wintercress (*Barbarea vulgaris*) grows in great abundance near the woods and also to some distance within the borders of the woods, and it was in the area where the wintercress grew thickest that the butterflies were seen.

Returning to the same field with Hugh Upham Clark on May 30 and 31, I found the late-spring form of this butterfly very common, while a few of the early-spring form were still on the wing. It was far more common than the very infrequent cabbage butterfly (*Pieris rapae*), of which only two or three were seen on May 30 and none on May 31. Instead of being confined more or less closely to the borders of the woods the butterflies were scattered everywhere over the open fields, being especially numerous in the higher and more barren portions. One or two, or even more, were always in sight. On each day 11 were caught in about an hour and a half, and many more were seen. A mated pair and two fluttering about each other were caught in immediate succession, so that I had four in my net at one time.

These are the only records for the early-spring form (*vernalis*) and the late-spring form for this region.

Where the butterflies came from I do not know. I did not find the species in the same field during the preceding summer.

Habits.—The early-spring form (*vernalis*) of the checkered white frequents the borders of woods rather than the more open portions of the fields. But it never enters the woods, if badly frightened always making directly off over the open country. It is to be looked for especially where such plants as *Barbarea vulgaris* and *Sisymbrium thalianum* grow in abundance.

It has a fast, direct, and fluttering flight with rapid wing beats, and usually keeps between 3 and 4 feet above the ground or a foot or two above the tops of the plants over which it flies. When alarmed it makes off in a straight line with extraordinary speed. The flight of the early-spring form of *Pieris protodice* is very much like the flight of *Anthocharis genutia*, and, indeed, it is very easy to mistake the checkered white for the female of the orange tip. But *P. protodice* keeps always to the open, whereas *A. genutia* does not leave the woods, and the flight of the former is higher and faster than that of the latter.

The early-spring form of the cabbage butterfly (*P. rapae*) is more or less confined to the borders of woods, occurring in quite the same situations as the corresponding form of the checkered white. The nervous, fluttering, direct flight of the checkered white is very different from the much more irregular, zigzag, and indolent flight of *P. rapae*, in which the wing beats are slower and the arc through which the wings are moved is greater.

The habits of the late-spring form of this butterfly are so very different from those of the early-spring form as to make the two forms seem like different species. Like the late-spring form of the cabbage butterfly (*P. rapae*), it is a butterfly of the open country, where it is far commoner than it is near the borders of woods. But unlike the corresponding form of the cabbage butterfly it frequents the more barren and more exposed and higher areas of the open fields.

The flight of the late-spring form of *Pieris protodice* is very fast, but also very irregular, the butterfly dashing this way and that and often doubling on its course in the most erratic fashion, always keeping about 3 feet above the ground. When frightened it makes off at amazing speed with a rapid succession of wild dashes of about 10 feet from side to side, but it does not rise above the usual level of flight. If very badly frightened, the angles between the straight dashes become so sharp that although the actual speed of travel is increased the speed in a straight line away from the pursuer is much reduced, and the insect may be easily followed up and intercepted. The males have a somewhat faster and more irregular flight than the females, but the difference in the flight of the two sexes is very slight.

A male and a female fluttering about each other dash this way and that with great rapidity, now rising as much as 20 feet above the ground, now coursing about just above the grass tops. Their actions remind one more of the actions of skippers than of the actions of other pierids.

The flight of the late-spring form is somewhat less fluttering or tremulous than that of the early-spring form, and, although it is stronger and faster, it resembles the flight of *P. rapae* much more closely than it does that of *Anthocharis genutia*.

The summer form resembles the late-spring form in habits, but it is rather less active and less shy.

The early and late spring forms, like all our spring pierids, pay little attention to flowers, spending practically all their time on the wing. I have seen only four or five engaged in feeding, all of them on the flowers of *Barbarea vulgaris.* The summer form, however, like all our summer pierids, is very fond of flowers.

When engaged in feeding the habits of *Pieris protodice* are very much like those of *P. rapae*, but it is less active and much less shy, so that if may often be taken with the fingers. Its flight from flower to flower is weaker and less energetic than that of *P. rapae.* The relative activity of these two species when feeding much resembles that between the yellow clover butterfly (*Colias philodice*) and the stronger orange species (*C. eurytheme*).

So far as I have seen the females of this species always feed with the wings closed over the back, but the spring males frequently feed with the wings extended horizontally, and the summer males commonly, or perhaps usually, feed with their wings parted at an angle of 90°.

Seasons.—This species probably appears here about the third week in March, flying through April and May and the first half of June. The second brood appears in July—probably toward the end of June—and flies until the advent of the third brood toward the end of August. Individuals of the last brood are on the wing until the end of the season.

Spring forms.—In the early-spring form the ground color of the wings above is clear chalky white in both sexes. The bases of the wings are heavily infuscated with dark gray, and the markings above are more or less reduced, but in the females more blackish than in the later forms. The spot near the inner (lower) border of the fore wings, about two-thirds of the distance from the base to the lower angle, is absent in the males and absent or greatly reduced in the females. Beneath, as described by Mr. Scudder, the hind wings are broadly and heavily banded with darkish olive-gray, there being between the bands only narrow more or less wedge-shaped bars of white before a sharply serrate narrow blackish-gray band in the middle of the outer half of the wing which caps more or less obscure tall whitish lunules. The males are as heavily marked on the hind wings beneath as the females, though in them the olive-gray is very slightly lighter. In flight this form appears distinctly grayish.

The fore wings measure 21 mm. in length in the males and 22 mm. or 23 mm. long in the females.

The late-spring form resembles the summer form, but it is rather less extensively marked above, and the females, though somewhat dingy as compared with the early-spring females, are of a purer white. Beneath, a few of the females are marked almost exactly as in the summer form, but most of them have the hind wings marked essentially as in the early-spring form, though the markings are less broad and are lighter and more yellowish in color. In the males the hind wings below show only faint traces of the markings of the early-spring form, consisting of a row of obscure chevron-shaped spots of dusky parallel to the outer border of the wing and about 4 mm. from it, a broad dusky band across the end of the cell, and a scarcely perceptible dusting of olive-gray scales in wide bands along the veins.

Fourteen males taken on May 30 and 31, 1931, have the fore wing from 23 mm. to 25 mm. (averaging 24 mm.) in length, and eight females taken on the same days have the fore wing from 23 mm. to 27 mm. (averaging 25 mm.) in length.

Two summer females from Cabin John at hand have the fore wings 26 mm. long.

Mr. Scudder gives the average length of the fore wing in the male as 23.5 mm., and in the female as 25.5 mm.

PIERIS RAPAE (Linnaeus)

CABBAGE BUTTERFLY

Plate 28, Figures 1 to 3; Plate 29, Figures 9, 10

Occurrence.—Common throughout the District, and in summer abundant in the vicinity of cabbage fields.

In spring this butterfly is rather local and infrequent, being found chiefly near the borders of woods, especially where there is an abundance of cruciferous plants. In summer it wanders more widely over open fields.

Within this area the cabbage butterfly is very unequally distributed. Broadly speaking, it is by no means so common as would be expected—indeed in many areas it is quite uncommon. Thus in the meadows at Cabin John, Md., one will not see more than half a dozen in the course of an entire day, even during the height of the season. In this area the only place where they are at all frequent is a small patch of about half an acre near a bridge crossing the canal. The butterfly is even less common in the open country at Silver Spring. But within a radius of a quarter of a mile or more about large cabbage patches it is very numerous, though by no means so abundant as farther north. On the cabbages themselves the caterpillars are not especially frequent and are greatly outnumbered by the caterpillars of the cabbage moth (*Autographa brassicae*). The cabbage butterfly is frequently seen throughout the gardens, parks, and even streets of the city. Many of these individuals come from pupae formed by caterpillars that have crawled from cabbages exposed for sale. Others were raised on various cruciferous plants, native, introduced, and cultivated, in gardens and in unkept yards and lots. Still others fed when young upon nasturtiums, to which the caterpillars are occasionally destructive.

There are seven specimens from the District and vicinity in the National Museum. Of the two males one is dated April 30, 1915 (Chittenden), and the other September, 1898 (F. C. Pratt). A female is dated June 28, 1889, and another is labeled "on violet, issued September 7, 1898." There are two females from Arlington, Va., taken on June 29, 1916 (V. A. Roberts). There are five specimens in the Schönborn collection, and Mr. Shoemaker has specimens from Arlington County, Va., just over the Free Bridge, taken between April 25 and May 1.

Habits.—The cabbage butterfly has a very meandering, but rather active, flight, coursing hither and thither 1½ or 2 feet above the ground. Its restless turning first to one side and then to the other and its frequent doubling on its tracks are very characteristic. The males are more active than the females, more constantly on the wing and resting less frequently and for shorter periods; their flight is also stronger and more irregular.

It has long been known that this butterfly has a partiality for white flowers, though it often visits flowers of other colors, especially clovers. During the approach of a storm I have seen it searching along a privet hedge for whitened leaves under which to rest.

When mated pairs are disturbed the male flies off carrying the female.

Not infrequently this butterfly appears in houses in midwinter, especially in the country districts, though sometimes even in Washington. It is abundant about farms wherever cabbages are grown, and the caterpillars often pupate on firewood if it happens to be piled near a cabbage patch. When the wood is brought into the house for burning the warmth of the house causes the pupae to give forth the butterflies, which are usually first noticed fluttering about the windows.

Seasons.—The European cabbage butterfly first appears early in the third week in March and by early April it has become common. The females appear about a week later than the earliest males. The butterfly continues to fly through May, but becomes very scarce toward the end of the month. A few fresh individuals appear during the first week in June, and before the middle of the month the species is again common. Fresh individuals appear throughout July and in increasing numbers until the end of the summer. The third brood appears in the early part of August, but its appearance is masked by the great number of butterflies of the previous brood still on the wing. From about the middle of June onward caterpillars in all stages and adults are always present.

Notes.—The earliest individuals to appear are small and chalky white with the tips of the wings pale gray (pl. 28, fig. 1; pl. 29, figs. 9, 10). In the males (pl. 29, figs. 9, 10) there is usually a small gray spot on the fore wings in the center of the inner half of the interspace between veins M_3 and M_2, and often a gray spot on the costal margin of the hind wings; but the wings may be wholly unmarked except for the gray tips. The bases of the wings are rather extensively and thickly studded with blackish scales. Early-spring females (pl. 28, fig. 1) are faint ivory white with the tips of the wings pale gray and the spots very much reduced in size and poorly defined. The inner portion of the wings, on the fore wings extending nearly to the end of the cell, is heavily sprinkled with gray scales.

About the middle of April larger butterflies appear, of which the males have the infuscation at the base of the wings less extensive and the spots on the wings larger. These are of the same size as the butterflies of the second brood (pl. 28, figs. 2, 3) and in color are intermediate between the individuals of the two broods.

Summer males (pl. 28, fig. 2) have the dark apical patch on the fore wings considerably larger than spring males (pl. 29, fig. 9), and also darker, especially the inner portion, where the scales may be quite black. There is commonly a slender tooth of black running inward along the lower radial vein. The spot on the fore wing is larger and darker, especially on the underside, and there is a gray spot below it near the inner border. The spot on the costal border of the hind wings is large and dark. The inner portion of the wings is much less heavily infuscated, and the lower surface of the hind wings is less extensively stippled with dark scales—indeed, in some examples these may be very few. Occasionally summer individuals occur in which the dark apical patch is reduced, the spot on the fore wings is small, and the faint spot below it and that on the costal border of the hind wings are merely vestigial; but these have the other features characteristic of the summer form. In the summer females the dark apical area of the fore wings is more extensive than in spring individuals, and much darker. It either extends so as to include the end of the lower radial vein, reaching the outer margin halfway between the lower radial and M_3, in which case M_2 may be dusky at the tip, or it terminates in the interspace between the upper and lower radials, in which case a narrow dark triangle extends inward for some distance along M_3; this triangle may be quite isolated, or it may be united basally with the patch above. The two spots on the fore wing and the spot on the hind wing are very much larger and darker than in the spring form. There is commonly a narrow dusky line extending inward from beneath the middle of the lower spot along the inner border, and rarely the two spots on the fore wing are more or less connected by a crescent of dark scales thickest in the middle with the convexity outward.

Remarks.—The cabbage butterfly first appeared in the District in 1872. The distribution of this insect in this region, especially its frequency in small open areas near woods remote from farms, suggests that here it feeds largely on native, or at least uncultivated, cruciferous plants.

Dr. E. A. Schwartz has found the eggs on *Barbarea vulgaris.* He says:

> On April 25th, Mr. Smith and myself made an excursion on the Brightwood road near Washington, and, while observing several specimens of *Anthocharis genutia,* Mr. Smith mentioned that Mr. Schönborn had just found the eggs of *Anthocharis genutia* on two species of Cruciferous plants, one of them being the common Winter Cress (*Barbarea vulgaris*). As several specimens of this plant were just then in blossom along our road, we went at once to work to examine them. Within a few minutes several butterfly eggs were found attached singly to the larger leaves, and more especially to such plants as grew isolated. Upon comparison, however, these eggs proved to be different from those of *Anthocharis,* and, in short, turned out to be those of the common *Pieris rapae.* The Winter Cress is not mentioned by Dr. Riley (Rep. of the Comm. of Agric., 1883, p. 111) among the known food plants of the Imported Cabbage Butterfly, and also in Europe thé same plant is not known to be attacked by this species. At least Kaltenbach does not mention it as such.
>
> *Pieris rapae*—as is well known—is one of our earliest butterflies, appearing in the vicinity of Washington toward the end of March. As there are no cabbage plants in the fields thus early in the season, it appears highly probable that the first annual generation of *Pieris* larvae normally subsists on some wild plant, and this common Winter Cress will no doubt be found to be the principal food plant of this species, though it cannot be asserted that it is the only food plant thus early in the season.

NOTE

In addition to the species of Pierinae considered in the preceding pages, the following might be expected to occur in the District:

Zerene caesonia (see p. 251).
Pieris virginiensis (see p. 251).
Anthocharis olympia (see p. 252).

Subfamily PAPILIONINAE

Genus PAPILIO Linnaeus

KEY TO THE SPECIES OF THE GENUS PAPILIO

a^1. White or greenish white with broad dark-brown bands and a scarlet spot at the anal angle; tails very long and slender with straight slowly converging sides (pl. 48, figs. 1, 2; pl. 49, figs. 1, 2) ---------------------------------- marcellus (p. 197).

a^2. Color not white and dark brown; tails shorter and broader, spatulate.

  b^1. Undersurface of the wings chiefly yellow.

    c^1. Upper surface of the wings yellow with a broad black border including submarginal lunules or broad dashes; fore wings with four black bands extending downward from the costal margin, only the innermost reaching the lower margin; hind wings with a long narrow black stripe and the inner margin narrowly black (pl. 33, figs. 1, 2). glaucus (p. 179).

*c*². Upper surface of the wings chiefly brown; fore wings with a broad band of yellow from the apex to the inner third of the lower border, and a curved row of submarginal spots; hind wings with a row of large yellow spots in the outer third, and a broad transverse yellow band across the basal portion; a large yellow spot on the tail (pl. 31, fig. 1; pl. 32, fig. 1) ------------------------- cresphontes (p. 178).

*b*². Undersurface of the wings chiefly black or blackish brown.

*c*¹. Undersurface of the wings with a single submarginal row of orange or yellow or orange and yellow spots.

*d*¹. Outer half of hind wings below metallic steel blue, this portion carrying a curved row of large rounded orange spots set in black, each with a small silver patch on the upper side; wings above brown or blackish brown, becoming metallic steel blue on the hind wings, with a submarginal row of small light spots (pl. 30, figs. 1, 2) ----------------------------- philenor (p. 174).

*d*². Outer third of hind wings below darker than the proximal two-thirds from which it is marked off by a narrow black line bordered outwardly by a narrow interrupted metallic blue line; submarginal spots consisting of stout orange and yellow crescents near the margin; hind wings above with scattered blue scales which become much more dense beyond a conspicuous narrow black line along the outer third; a conspicuous orange spot at the outer angle (pl. 40, fig. 1) ----------- glaucus (p. 179).

*c*². Undersurface of the wings with two rows of conspicuous orange or yellow or orange and yellow spots parallel to the margin.

*d*¹. Submarginal spots above clear yellow, on the hind wings sometimes tinged with orange; orange spot at the anal angle with a black center; inner row of spots below appearing on the upper surface as bright yellow spots, very large (male) or small and more or less obsolete (female) (pl. 41, figs. 1, 2) ----------------- polyxenes (p. 191).

*d*². Submarginal spots above greenish, darkest on the hind wings; no black in the orange spot at the anal angle; a large orange spot on the anterior border of the hind wings; inner row of spots below not appearing on the upper surface (pl. 45, figs. 1, 2) ---------------- troilus (p. 189).

PAPILIO PHILENOR PHILENOR Linnaeus

Blue Swallowtail

Plate 30, Figures 1, 2

Occurrence.—Common, but irregularly distributed, being abundant in certain places and in others scarce. I have found it most numerous in the meadows west of Cabin John, Md.

The blue swallowtail is especially a butterfly of open fields with an abundance of tall flowering plants in the vicinity of woods, of flower gardens, and of orchards at the time of flowering of the fruit trees. It is also to be found in open woods, especially along the roadsides. It is familiar to all who maintain gardens in the vicinity of Washington.

There are four specimens in the Schönborn collection, one, dated August 12, very large and evidently raised. A pupa is dated May 3, 1883. Mr. Shoemaker has specimens from the District.

Habits.—This butterfly has a wild impetuous flight, dashing from side to side and up and down and often doubling on its course in the most erratic manner at an average height of 3 to 5 feet above the ground. It is extremely nervous, and when feeding always keeps its wings in motion. But in spite of its intense activity and its restless nervous actions it is the least suspicious and least shy of all our local swallowtails.

It is preeminently a hot-weather butterfly and is seen to best advantage and in the greatest numbers only on the hottest summer days, from about 10.30 to about 3 o'clock.

On hot days it is noticeable that the females have a less impetuous, less irregular, and weaker flight than the darker males, though in the broader features by which the flight of the blue swallowtail differs from that of the other local species it is quite the same.

On occcasion this swallowtail may become aggressive. Once I was watching a male dashing irregularly about a field when an English sparrow (*Passer domesticus*) rose from the grass. The butterfly at once made after it and followed it for 50 feet or more, as far as the apple tree into which it flew.

This incident enables me to say that the speed of this butterfly and that of a frightened sparrow are approximately equal— roughly about 25 miles an hour.

This butterfly is extremely fond of flowers, especially such as grow from 3 to 5 feet above the ground or even higher, as the flowers of the lilac, peach, plum, buttonbush, and thistles, and various garden shrubs. But it also feeds greedily on the flowers of the butterflyweed, of other milkweeds, and of the red clover. In gardens, in common with the other swallowtails, it is most strongly attracted by the flowers of the lilac, the syringa, and the butterflybush.

Seasons.—The blue swallowtail appears about the last week in April and continues to emerge during May and the whole of June, remaining on the wing until about the end of July. The females appear at the same time as the males, and I have found both sexes frequent as early as May 4. In spring it is much less numerous than the other swallowtails—in fact, it is usually very scarce. It appears again shortly before the middle of August, increasing in numbers until the middle of September, when it is very abundant in certain localities, and then decreasing, although individuals are seen on the wing until late in October if the weather remains warm. Unusually large examples of both sexes are not infrequent late in summer.

The individuals emerging toward the end of June show the summer type of coloration.

In the District this swallowtail appears to hibernate only as a pupa, as none but fresh individuals are found early in spring.

The scarcity of this insect in spring, in striking contrast to its abundance in autumn, indicates an exceptionally heavy mortality during winter. It should be noticed that the second brood does not appear until more than a month later than the second brood of the other local swallowtails, and the individuals of the second brood do not become abundant until it is too late for their progeny to reach the pupal stage before winter. It may well be that the very small size and the scarcity of the individuals of the spring brood mean that only those individuals which, as caterpillars not yet quite fully grown, are in a condition to pupate with the coming of the cold weather are able to survive, the overwhelming majority of the individuals—adults and young caterpillars—being killed off each autumn.

Spring form.—Early-spring individuals (pl. 62, figs. 4 and 6) are always very small, having the fore wing about 40 mm. long. In contrast to all our other local swallowtails except *P. marcellus*, both sexes appear at the same time, and both sexes are of the same size.

A male in the National Museum collected by William Middleton at Falls Church, Va., on April 28, 1915, is typical of the spring form. The fore wing is 43 mm. long. The hair on the body is very long, giving the insect a shaggy appearance, and there is a tuft of long hair on the frons. The whitish spots on the wings are enlarged, resembling those of the summer females, and the color is dull, being scarcely brighter than in the brightest summer females.

A female captured at Great Falls on May 9, 1931, has the fore wings 40 mm. long. It is clothed with long hairs, like the male just described, and the white spots are enlarged.

The hind wings of spring individuals are more rounded than the hind wings of the individuals of the summer brood, and the tails are relatively shorter.

The two spring specimens noted, and others examined, agree perfectly in every particular with specimens of the Californian *P. philenor hirsutus*, and if that form is to be recognized they must be referred to it. This case is somewhat similar to that of *Argynnis aphrodite cipris*, which occurs as a definite geographical form in Utah, Colorado, and New Mexico, and is also found in eastern Massachusetts, where it seems to be merely a variant of the local *Argynnis aphrodite aphrodite*.

So far as I have seen, there is little difference between early and late spring individuals in size or color, but the later ones are less hairy.

Speaking of *P. philenor*, Lord Rothschild and Dr. Karl Jordan wrote that the spring specimens appear on the whole to be smaller than the later individuals, and bear always a row of spots on the upper side of the fore wing, this row being often absent from the males of the summer brood (or broods). The hairiness of the body varies considerably, early Californian specimens having quite a shaggy appearance. The difference between spring and summer individuals, according to my observations, reaches its maximum in the District.

In the summer brood the fore wings in both sexes vary from 45 mm. to 55 mm. in length, being usually about 50 mm. long; in occasional individuals they may reach nearly or quite 60 mm.

It is a matter of considerable personal interest to me that I was so fortunate as to have been able to show Dr. Karl Jordan, the leading authority on the *Aristolochia* swallowtails, the first living individual he ever saw. Before his visit to Washington a few years ago his experience in the field had been confined to Europe and Africa, where no species of this group occurs. While he was here we made a trip to Cabin John together, and he was lucky enough to catch a specimen of the rare spring form of *P. philenor*—which, incidentally, was the first example of it I ever saw.

Caterpillar.—The fully grown caterpillar is somewhat more than 2 inches in length, cylindrical, black or blackish, with large fleshy filaments along the sides of which the pair on the first segment are very long, nearly twice as long as any of the others, and are directed outward, upward, and a little forward.

When young the caterpillars are gregarious, ranging themselves side by side along the edge of a leaf and at right angles to the latter. Later they are sociable, though not gregarious, but in the last stage they are solitary and are found generally distributed over the food plant. Large caterpillars in confinement are likely to turn cannibal and eat one another.

The caterpillar feeds on the dutchmans-pipe (*Aristolochia sipho*), on the Virginia snakeroot (*A. serpentaria*), and occasionally on related plants. It sometimes does great damage to the first named when it is grown as an ornamental plant.

Chrysalis.—The chrysalis is very easily distinguished from that of our other local swallowtails. The ventral surface is swollen, and when the chrysalis is viewed from the side it appears to be strongly bent in the middle. When viewed dorsally the abdomen is seen to be much broadened, the anterior part being twice as broad as the thorax; this broadening is due to the development of broad lateral ridges.

PAPILIO CRESPHONTES Cramer

GIANT SWALLOWTAIL

Plate 31, Figure 1; Plate 32, Figure 1

Occurrence.—Formerly frequent but at present not occurring in the District area, although in certain places not far from the District, both in Maryland and in Virginia, it is not uncommon. Irvin N. Hoffman tells me that this species is to be found about Great Falls. The only one I have ever seen here was noticed at Cabin John in May, 1908. Dr. William Schaus informs me that he has seen it here. Herbert S. Barber took one at Plummers Island, Md., on July 1, 1913, and this specimen, now in the National Museum, represents the last record for the District area.

There are three specimens from the District in the Schönborn collection taken on May 3, 4, and 9, and a pupa without date. Franklin Sherman, jr., mentions having captured a specimen in Maryland 8 miles from Washington.

Seasons.—There are presumably two broods in the District, one flying from early in May until toward the end of June and the second flying from about the middle of July until after the middle of September.

Habits.—The flight of the giant swallowtail, though strong, is leisurely. The wings are flapped rather slowly, and the insect sails frequently, sometimes for long distances. Though quite different, the flight resembles that of the milkweed butterfly (*Danaus plexippus*) more than that of any of our other swallowtails.

When on the wing this butterfly is at once distinguishable by the great contrast between its brown upper and bright yellow lower surface.

It is fond of flowers and where it occurs it is a frequent visitor to gardens. It is also fond of sipping moisture from mud and is sometimes seen thus occupied in farmyards.

Caterpillar.—The caterpillar, which in the South is known as the "orange dog," is nearly 2½ inches long when fully grown. It is dark brown with the hinder end yellow, a large yellow saddle-shaped spot formed by the union of two large more or less triangular lateral spots in the middle of the body, and a broad yellow stripe reaching from the head to above the last pair of true legs.

It feeds on a wide variety of different plants, though chiefly on plants of the orange family (Rutaceae). In this region it is to be looked for particularly on the prickly-ash (*Zanthoxylum americanum*) and on the hoptree (*Ptelea trifoliata*).

In the South it is occasionally destructive to young orange trees.

Chrysalis.—The chrysalis has the surface strongly rugose; the anterior half of the body is bent upward at a considerable angle, the ventral profile being a rather abrupt rounded angle. It resembles most closely the chrysalis of *Papilio polyxenes*, but it is larger, with the ventral profile much more strongly bent, and there is a prominent compressed tubercle at the base of the antennae, which is lacking in the chrysalis of the parsnip swallowtail.

PAPILIO GLAUCUS GLAUCUS Linnaeus

YELLOW SWALLOWTAIL

Plate 33, Figures 1, 2; Plate 34, Figures 1, 2; Plate 35, Figure 1; Plate 36, Figure 1; Plate 37, Figures 1, 2; Plate 38, Figures 1, 2; Plate 39, Figures 1, 2; Plate 40, Figure 1

Occurrence.—Common, though not abundant, throughout the District and the surrounding country, the numbers fluctuating but little from year to year.

This butterfly frequents especially the drier open deciduous woods, the borders of woodlands, and orchards, from which it wanders into gardens, and when an abundance of red clover, thistles, milkweed, or other flowers serves to tempt it, it strays more or less widely out over open fields. It is, however, essentially a woodland species, finding its proper home in glades, along the sides of roads, and about the banks of rapid streams, and in open country the individuals, especially the females, are always more numerous near the borders of the woods than elsewhere.

Habits.—The yellow swallowtail usually flies high, from 10 to 20 or more feet above the ground, with a leisurely, though rather rapid, flight, often meandering irregularly about, turning from side to side, now rising several feet, now coming down again, flapping and sailing. In open glades, along the banks of streams, and on the borders of woodlands it plays about, flying leisurely up and down, from the tops of the trees nearly to the ground and up again. When traveling over clover fields it keeps close to the grass tops, coursing about and occasionally turning to the right or left. In open country the contrast between the actions of this butterfly and the rapid, nervous, and irregular flight of the parsnip swallowtail is very striking. It has been remarked that especially early in the morning, and also after rains, the yellow swallowtail is fond of sunning itself on leaves with its wings extended almost to the horizontal and held at right angles to the sun's rays.

It is exceedingly fond of flowers, and from early in spring, when the lilac and syringa are in bloom, to late in autumn it is one of the most frequent and conspicuous visitors to gardens. In summer it feeds especially on elder, clover, butterflyweed, and milkweed, later on the buttonbush, and toward the season's end on thistles, on ironweed, and on joe-pye-weed and related species.

When feeding the wings of the females and of the larger males are held motionless and fully extended, with the fore wings drawn well back, the attitude being quite the same as that assumed when enjoying the warmth of the sun's rays. Because of this peculiarity, as well as by its less hurried and less irregular flight, the black form of the yellow swallowtail is in life readily distinguishable from our three black swallowtails. The small males flutter their wings more or less continuously when feeding, somewhat after the fashion of the parsnip swallowtail (*P. polyxenes*).

Of all our swallowtails this is the most fond of carrion and of filth, which seem to have an irresistible attraction for it and about which it will sometimes gather in surprising numbers. Not infrequently it will so gorge itself with liquid from a rotting carcass as to become helplessly intoxicated.

It is also very fond of congregating on muddy spots in roads, on the damp earth on the side of pools or ponds, or puddles in the half dry beds of streams. It frequently is seen, often several or even many at a time, hovering about wet spots near barns or houses.

The males are more active and more restless than the females, more constantly on the wing, and more given to playing about the trees and to wandering.

The small individuals common in spring are more active and shier than the large individuals of the summer broods, and also they seem less inclined to wander. At any rate early in spring this butterfly is much less often seen away from woods than later in the year, though this may in part be due to the lesser number of the individuals.

Broods.—There are two broods a year. The butterfly first appears in the first week in April, and individuals continue to emerge until about the middle of June. During June the numbers decrease, and by the last week in the month the species has almost completely disappeared. The males have been flying for a week or more and have become common at the time of the first appearance of the females. The earliest individuals of both sexes are always of small size. As spring advances the size of the individuals gradually increases, so that the late individuals of spring brood are as large as the majority of the individuals of the summer brood. Occasional males of the second brood appear about the middle of June, and by about the first of July or shortly after the butterfly has become common. Individuals continue to emerge nearly throughout August, but after the middle of August the numbers fall off, and in September only worn individuals are found, a few of which may still be seen as late as the middle of October. The individuals of the second brood are much more numerous than are those of the first. Practically all the summer individuals are large, and in August and early in September extremely large examples are not infrequent.

Local varietal forms.—This butterfly is usually described as dimorphic, with a single yellow form in the male and two types of females, one yellow and the other brownish black.

In the vicinity of Washington its peculiarities are properly understood only by recognizing the existence of six more or less intergrading forms in the female and three in the male.

The yellow female with essentially the male type of coloration corresponding to the yellow male of the small northern subspecies (*canadensis*) does not here occur so far as known.

The commonest female form is the well-known brownish-black *glaucus* (pl. 40, fig. 1). Usually approximately half of all the females are of this type, but the proportion of black to yellow females varies from season to season and from year to year. In the spring brood yellow females as a rule outnumber the black, and, indeed, black females may be relatively rare. In the summer broods the black females usually outnumber the yellow, but in 1927 the yellow females were somewhat more numerous than the black.

In the black females (*glaucus*) the ground color varies from a rather light brownish to a deep, sooty black. The variation is especially marked on the undersurface of the wings, where the black markings corresponding to those of the males may be scarcely discernible, or may be sharply contrasted against a rather light-grayish or rusty-brown background. An examination of the underside of the fore wings, of which the ground color is always darker than that of the hind wings, shows that the black band crossing the outer portion of the cell has moved distally so that it is very near the short band crossing the end of the cell. The narrow area between these bands may be of the same color as the general ground color of the wing, or it may be on both surfaces a conspicuous, deep yellow to whitish band. Most commonly this band is vestigial, and often no trace of it can be detected. The amount of blue scaling on the upper surface of the hind wings varies somewhat. In the great majority of individuals very abundant blue scales occur basalward about as far as the origin of M_2, enter the cell as far as the position of the narrow black stripe in the yellow forms, and extend forward as far as SC_1. Farther within the cell there are often widely scattered blue scales, and there are usually scattered blue scales above SC_1. These last are commonly segregated on the inner side, or on both sides, of the position of the black stripe, and are not infrequently continued onto the lower margin of the fore wing just above. Over the position of the short black band at the end of the cell and of the black stripe blue scales are either absent, or less numerous than elsewhere. On the fore wings near the outer border there is a large lunule of blue scales and above it from one to four more, which diminish in size and in intensity. Very rarely blue scales are wholly absent from within the discal area of the hind wings and also wholly absent from the fore wings. The hind wings are moderately scalloped and the tails are broad. Only rarely are the hind wings deeply scalloped and the tails narrow in the basal half.

The next commonest female form (No. 2; pl. 37, fig. 2) in the vicinity of Washington is more or less deep ochreous-yellow. The outer border of the hind wings is deeply scalloped, and the tails are much narrowed at the base. The discal area of the hind wings commonly shows a few scattered blue scales in the outer portion, and there may be a considerable number of these. More than half of the yellow females are of this form, which is the only yellow female recorded in the spring brood.

The third commonest female (No. 3; pl. 37, fig. 1) is light, clear yellow. The three bands across the cell of the fore wing are equally spaced, as in the preceding form. The hind wings are only moderately scalloped, and the tails are broad. In the shape of the wings this resembles the black females more than it does the females of the yellow form just described.

The fourth female (No. 4; pl. 38, fig. 1) resembles the preceding, but the upper surface of the hind wings shows the abundant blue scaling characteristic of the black form, which gives them a whitish appearance and an opalescent sheen. Blue scales also occur on the basal side of the lower end of the innermost black band on the fore wings, in the same position in which they are frequently found in the black females. On the fore wings the black band across the outer portion of the cell has moved outward so that there is only a narrow yellow patch between it and the band crossing the end of the cell. This form is fairly common. It intergrades more or less with the preceding, while the ochreous females sometimes approach it in the amount of blue in the discal area of the hind wings.

The fifth female form (No. 5; pl. 38, fig. 2) resembles the preceding in the shape of the wings, in the occurrence of an abundant blue scaling on the discal area of the hind wings, and in the approximation of the two outer black bars across the cell on the fore wings. It differs in having the yellow areas of the wings, which are very light and whitish, speckled with black scales which between the wing bases and the innermost band on the fore wings and the long narrow stripe on the hind wings are extremely numerous, equaling or exceeding the whitish-yellow scales in numbers.

W. H. Edwards has figured a female which resembles this except that the ground color of the wings is a rather deep yellow. It is quite likely that this infuscated female form occurs in both light and ochreous phases.

The sixth female form (No. 6; pl. 39, figs. 1, 2) is black or brownish black with the yellow areas of the fore wings beyond the innermost black band and of the hind wings beyond the narrow black stripe thickly speckled with yellow or whitish scales, most abundantly toward the lower border of the fore wings and the upper border of the hind wings. Like the preceding, this form seems to have both a whitish and an ochreous phase. The latter was figured by W. H. Edwards. This form is infrequent, though not rare, at least in certain seasons. I took one at Cabin John in 1925 and five at Silver Spring in 1927. A yellow female taken September 1, 1928, is curious in having a considerable dusting of dark brown scales on the fore wings between the lower borders and vein M_2.

The males are divisible into the usual clear light yellow males, which are by far the commonest, ochreous males, which are rather rare, and short-winged males in which the outer and lower margins of the fore wings are at right angles to each other, and the hind wings are unusually broad.

The interrelationships of the several local forms of the female of this butterfly when typically developed may be appreciated from the following key:

KEY TO THE FEMALE FORMS OF PAPILIO GLAUCUS

a^1. Predominantly yellow.

b^1. Yellow between the base of the wings and the innermost band on the fore wings and the long stripe on the hind wings the same as that of the other yellow areas.

c^1. Yellow of wings ochreous, usually darkest on the fore wings and on the inner half of the hind wings; tails slender, narrow throughout, or much broadened in the outer half; scallops of the hind wings deep; process between tail and anal angle long, with the sides of the black central portion parallel for some distance (pl. 37, fig. 2) ------------ No. 2.

c^2. Yellow of wings light and clear; tails broad; scallops of the hind wings relatively shallow; process between tail and anal angle short, the sides of the black central portion converging, not becoming parallel.

d^1. Few or no blue scales on the discal area of the hind wings (pl. 37, fig. 1) ------------------------------------ No. 3.

d^2. Yellow of hind wing thickly speckled with blue scales, appearing opalescent whitish; blue scales also occur along the basal side of the lower end of the innermost black stripe on the fore wings (pl. 38, fig. 1) ------------- No. 4.

b^2. Region between the base and innermost band on the fore wings and the base and narrow stripe on the hind wings deeply infuscated with sooty brown scales, which are also thickly speckled over the remaining yellow areas (pl. 38, fig. 2) -- No. 5.

a^2. Predominantly deep brown or brownish black.

- b^1. Wings beyond the position of the innermost black band on the fore wings and the narrow black stripe on the hind wings with the black markings standing out prominently against the lighter background which is dusted with yellow or whitish scales, these becoming most numerous toward the lower margin of the fore wings and the upper margin of the hind wings (pl. 39, figs. 1, 2)__________________________ **No. 6.**
- b^2. No yellow or whitish scales on the upper surface of the wings other than those in the submarginal spots (pl. 40, fig. 1)______ **glaucus.**

There are a number of other forms of the female of this butterfly that have not been found in the District area, though probably some, at least, will be taken here. Several of the forms, so far as I have been able to learn, are of rather limited distribution, while a few are very widely spread.

An intensive study of this insect based on large numbers of individuals from all portions of its range would probably give results of great interest when compared with the work that has been done on the African *P. dardanus* and on certain Asiatic species.

The several varieties of the female of the yellow swallowtail are herein designated by numbers in order to avoid burdening the already overtaxed nomenclature of the swallowtails with names, some of which would represent stable, but others indefinite and very variable intergrading, forms.

It should be mentioned that a satisfactory study of the females of this species can only be made on fresh specimens, as the cream-yellow forms gradually change to ochreous in a few months even if kept from the light.

Spring forms.—The earliest (early April) spring males are very small with the fore wings from 42 mm. to 45 mm. in length. The hair on the thorax and abdomen is very long, and there is a conspicuous tuft of long hair on the frons.

On the upper surface the black border of the hind wings is narrower than it is in the summer form, and the yellow crescents included in it are larger. The black border of the fore wings is slightly broader anteriorly than posteriorly, the reverse being true in the summer form, and the yellow spots included in it are larger. The black abdominal border of the hind wing is usually much broader than the interspace between it and the cell.

On the lower surface the dark margin of the hind wings is markedly narrower than it is in the summer form, and its inner border is a straight instead of a scalloped line; it is much more heavily suffused with light scales than it is in the summer form, and the submarginal crescentic spots are very much larger. On the underside of the fore wings the submarginal yellow spots in the black border are larger than in the summer form and are usually confluent, forming a rather broad yellow band with a gently scalloped inner border, though they may be separated at the veins.

As the season progresses the size gradually increases, and in June the males are for the most part of full size with the fore wings up to 55 mm. in length. In color these males are intermediate between the early-spring and the summer males, though mostly rather close to the latter. The body is much less hairy than in the early males, and the hair on the frons is usually short, though occasionally nearly as long as in some of the early males.

Most of the early-spring males resemble very closely in color males taken in the summer in the vicinity of Boston, but many show an even closer approach to the northern *P. g. canadensis.*

The earliest spring females available have the fore wings from 50 mm. to 55 mm. long. There is the same conspicuous tuft of long hairs on the frons that characterizes the early males. The submarginal crescents on the hind wings and submarginal spots on the fore wings are much enlarged, especially below, and the dark outer border on the hind wings (and the corresponding area in the black females) is narrowed and more heavily suffused with light scales, while its inner border is more or less straightened. If without locality and date early-spring black females, by comparison with the males, would certainly be considered as belonging to the form found in eastern Massachusetts instead of to the local form.

Late-spring females, like late-spring males, are intermediate between the early-spring and the corresponding summer forms, becoming progressively nearer the latter.

Summer males have the fore wings from 50 mm. to 60 mm. in length, most of them having the fore wings about 55 mm. long or slightly less.

Summer females have the fore wings from 55 mm. to 69 mm. long, the usual length of the fore wings being slightly less than 60 mm. Specimens with the fore wings more than 65 mm. long are rare.

Systematic status of the spring form.—If their origin were unknown, many of the small very early spring males of local *Papilio glaucus* would unhesitatingly be referred to *Papilio glaucus canadensis*, from which there is no way of distinguishing them. If we are to follow the facts as they are brought out by the actual specimens, the range and status of the form known as *Papilio glaucus canadensis* would be as follows: Alaska and northern British Columbia to Anticosti, Newfoundland, and New Brunswick, and as a progressively earlier spring form (followed later in spring by intermediates and by *P. g. glaucus*) at length consisting of males only, southward to the mountains of North Carolina.

According to this interpretation *P. g. canadensis* represents the species exclusively in Canada, but south of Canada occurs only as a spring form.

Comparable cases are found in *Papilio philenor*, which early in spring in the District is represented by the western *P. p. hirsutus;* in *Argynnis aphrodite cipris*, which occurs in the West as a definite geographical race and in eastern Massachusetts as a form of the local *A. a. aphrodite;* and in *Papilio troilus*, in which the southeastern race, *P. t. ilioneus*, occasionally appears in the District late in summer apparently as a variant of the local *P. t. troilus*.

All the early-spring specimens of *Papilio glaucus* referable to or approaching *Papilio glaucus canadensis* that I have seen have been males, the first females to appear being intermediates. In this connection it may be mentioned that in *P. g. canadensis* as it is found in Canada the males outnumber the females about 40 to 1, on the basis of figures derived from general collecting, while in the southern *glaucus* in summer the males outnumber the females less than 3 to 1. So it is perhaps not surprising that toward the southern limit of its range in the form *canadensis* the females wholly disappear.

The local males of the *canadensis* type are very fond of congregating on mud just as they are in the north. But after the appearance of females and of intermediate males this species seems to give up the mud-frequenting habit until the appearance of the second brood in midsummer. More observations on this point, however, are needed.

Comparisons.—In eastern Massachusetts in the vicinity of Boston the local summer form of the yellow swallowtail is intermediate between the southern (*glaucus*) and the northern (*canadensis*) type.

The males (pl. 34, figs. 1, 2) are light clear yellow, and are of the same size as the great majority of the males from the vicinity of Washington (pl. 33, figs. 1, 2), being therefore larger than the males of typical *canadensis*. The black markings show the same range of variation as in the local males, and the submarginal yellow spots seem to be the same. Though generally speaking the black border on the hind wings is of about the same width in specimens from Boston and from Washington, it is occasionally much narrowed in the former and much broadened in the latter. There is a slight average difference in the amount of blue scaling in the black margin of the hind wings, this being more developed in southern specimens. Some individuals from both localities have hazy and indefinite blue areas in every interspace between the marginal lunule and the yellow discal area, the one nearest the anal ocellus and above the orange lunule being the largest, more densely scaled in southern than in northern examples, the next two of rapidly decreasing size, and the remainder vestigial except for that within the orange anterior lunule, which is narrowly linear and bright. The yellow submarginal lunules on the hind wings vary from strongly crescentic to practically linear in both localities, and the series of submarginal yellow spots in the black border of the fore wings varies from a series of narrow dashes to a series of well-rounded oval spots.

On the underside of the fore wings the males from Boston (pl. 34, fig. 2) frequently have the submarginal yellow spots united in a continuous band with straight edges, which is as wide as the black-margined olive-gray band just within it. Sometimes this band is crossed by narrow black veins, and its inner border is slightly indented where these veins enter. Usually the band is narrower than the olive-gray band, sometimes scarcely half as wide, and is crossed by conspicuous black veins, the margin where these veins enter being deeply, though narrowly, notched. Exactly this condition is frequent in specimens from Washington. Here, however, the notches at the entry of the veins are as a rule broader and deeper and the black scaling on the veins is broader, so that instead of a band there is a series of isolated yellow spots, at the apex half moon shaped but rapidly decreasing in width and becoming linear and widely separated posteriorly.

On the hind wings in specimens from Boston (pl. 34, fig. 1) the black abdominal border is usually somewhat broader than the yellow interspace between it and the cell, but in some cases it is more or less considerably narrower. In specimens from Washington (pl. 33, fig. 1) this black abdominal border is always narrower than the yellow interspace between it and the cell, though occasionally not much so.

On the underside of the hind wings in specimens from Boston (pl. 34, fig. 2) the limbal area is as a rule, though not invariably, much lighter in color than in specimens from Washington (pl. 33, fig. 2), because of a greater development and more uniform distribution of blue-gray scales, while the narrow black inner border of the limbal area as far as vein R_3 is made up of a continuous series of straight lines instead of being composed of a series of curved lines as in the case of specimens from Washington. Occasionally these lines are slightly curved, while they may be nearly straight in examples from Washington.

Summing up the characters of the males from Boston and from Washington, there is an appreciable average difference in color, with, however, broad overlapping. Only in features of the limbal area of the underside of the hind wings, the general color and the line forming its inner border, do the groups of males approach each other without an overlap.

About Boston there are ochreous and short-winged males exactly corresponding to similar males in the vicinity of Washington.

In the vicinity of Boston the usual type of female is light clear yellow, and of the same size as the male, or only very slightly larger. The color pattern is essentially that of the male, though usually the black markings are somewhat heavier. There is also another type of female which is ochreous in color and seems to occur only in the summer brood and among the latest individuals of the spring brood.

In the character of the submarginal band on the undersurface of the fore wings and in the characters presented by the limbal area on the undersurface of the hind wings the light yellow females show the same intergradation with more southern specimens as do the males. This is especially interesting in view of the fact that they never depart from the characteristic male color pattern further than to show a slight increase in the size of the black markings and usually also a broadening of the black border of the hind wings, on which there are always, in the specimens at hand, patches of scattered blue scales between the marginal lunules and the yellow discal area, such as rarely occur in the males.

The ochreous females from Boston are usually considerably larger than the males and the light-yellow females. The black markings are very heavy. The submarginal band on the undersurface of the fore wings is usually of the *canadensis* type, and they usually agree with *canadensis* rather than with *glaucus* in the characters of the limbal area on the undersurface of the hind wings. I have a specimen, however, which, together with an uninterrupted band on the undersurface of the fore wings, has the limbal area of the undersurface of the hind wings bordered by broad crescents with pointed ends which are more deeply curved than in any southern specimen at hand. Though in the ochreous females the amount of blue scaling on the limbal area of the hind wings above is usually no greater than it is in the light-yellow females, it occasionally takes the form of a large and conspicuous blue spot in each interspace, which is quite as large as in some of the ochreous females from the vicinity of Washington. The black markings in the ochreous females from Boston are always more extensive than in the females from farther south.

The two types of females found about Boston seem to intergrade. The light-yellow female scarcely differing from the male in coloration is quite different from any of the female types found in the vicinity of Washington, this difference being particularly marked by the absence of extensive blue scaling on the hind wings. The northern ochreous females are always more heavily marked than those from the south, but they approach the latter in the occasional great development of the blue patches on the hind wings.

The individuals of the spring brood in eastern Massachusetts are more like the northern and less like the southern form than those of the summer brood, especially the females.

Caterpillar.—The fully grown caterpillar is commonly known as the "elephant worm." Just behind the rather small head the body is much swollen, from this swollen portion tapering gradually to the hinder end. The color is rich velvety green, becoming paler below. The third segment behind the head bears two large and conspicuous eye spots, while the following segment is bordered behind with yellow and the next is edged in front with black.

There is no other caterpillar with which this could possibly be confused, except perhaps that of the spicebush swallowtail (*Papilio troilus*). But the latter is darker in color and there is a pair of black-edged bright patches just behind the eye spots.

Just before changing to the chrysalis the caterpillar becomes on the swollen anterior segments a dull dirty green, and posteriorly a grizzly green.

The caterpillar feeds on a very large variety of trees and bushes, in this region living always high above the ground. It is to be looked for especially on the tuliptree (*Liriodendron*), ash, hoptree, and on fruit trees. Farther south it sometimes does considerable damage to shade and forest trees.

Chrysalis.—The chrysalis has a rough and rugose surface, the anterior half makes a straight line with the posterior half, and the abdomen is not expanded laterally; by these characters it is easily distinguished from the chrysalids of all our other swallowtails. In color it is mottled brown, occasionally more or less extensively marked with green.

PAPILIO TROILUS TROILUS Linnaeus

SPICEBUSH SWALLOWTAIL

Plate 44, Figure 2; Plate 45, Figures 1, 2; Plate 46, Figures 1, 2

There can, I think, be no doubt that the insect recorded by Warden under the name of *Papilio polydamos* is in reality this species. His specimens were damaged in transit, and it would be very easy to mistake a damaged *troilus* for *polydamas*.

Apparently Warden's determinations were made with the aid of Drury's figures. Under the name *troilus*, Drury, through an error in determination, figured the male and female of *P. polyxenes*, and the figure in Drury's work which is most like *troilus* is that of *Papilio polydamas* [*antiquus*] from Antigua.

Occurrence.—Common throughout the District and the surrounding country, in some seasons very common. Within the District it is much less abundant than in former years, and its numbers seem to be steadily decreasing.

The spicebush swallowtail is a woodland species, and is less frequently seen in fields and gardens than the yellow, parsnip, or blue swallowtails. It is especially to be found in low damp woods, particularly in the vicinity of marshy spots, where it is the commonest and most conspicuous of the butterflies. It becomes less common in the drier woods, where the yellow swallowtail prevails, and in the open fields.

Habits.—The spicebush swallowtail is more active than the yellow swallowtail and has a more nervous, more rapid, and less irregular flight, which is usually from 5 to 10 feet above the ground. It gives the impression of being a serious-minded butterfly, flying steadily along, pausing frequently, then going on again, seldom alighting. It is the only local swallowtail that seems to be thoroughly at home in deep shady woods.

On coming to a road this swallowtail, like *P. palamedes*, almost invariably flies directly across it 3 or 4 feet above the surface. All our other swallowtails usually turn and fly along the roadside, or for some distance along the road itself. If they cross the road they do so at any angle.

The males and females appear to be quite alike in habits, and the relative proportion of the sexes seems not to vary with locality.

The large individuals of the summer brood are more indolent and have a somewhat more leisurely flight than the smaller ones that fly in spring.

This species is fond of flowers, though less strongly attracted by them than are our other swallowtails. In spring it favors especially the flowers of the Japanese honeysuckle, which grows in profusion in its chosen haunts. Later it is to be found feeding with the other swallowtails, particularly on clover and on thistles growing near the woods. When feeding it often, but not always, keeps its wings in motion; small spring individuals are more likely to do this than the large ones of the later brood. It is occasionally to be seen hovering about damp spots, and shows an interest in filth and carrion, though by no means the intense interest exhibited by the yellow swallowtail.

The actions of the spicebush swallowtail may briefly be described as intermediate between those of the yellow and the parsnip swallowtails.

Broods.—The spicebush swallowtail has two broods a year. It first appears, in small numbers, in the latter half of April or early in May according to season, the males flying about a week before the females. Toward the end of May it is usually very common. The numbers then decline, but fresh individuals again appear about the middle of June and slowly increase in numbers so that by August the insect has become abundant. Fresh individuals continue to emerge until at least the middle of September, and the butterfly can be seen until well into October. August and early in September are the periods of greatest abundance, and also, as in the case of the yellow swallowtail, the periods of maximum dispersal.

Note.—The National Museum contains a female of the form *radiatus* taken by D. B. Mackey in Washington on November 10, 1907 (pl. 46, figs. 1, 2).

Caterpillar.—The caterpillar of the spicebush swallowtail is called the "mellow bug." It resembles that of the yellow swallowtail but is of a darker green, and behind the conspicuous eye spots on the third segment behind the head there is a pair of buff spots edged with black, which are a little more than half as large as the eye spots in front of them.

The caterpillar feeds on a number of different plants, but especially on the sassafras and spicebush.

It is recorded (Insect Life, vol. 5, no. 3, p. 207, January, 1893) that at Falls Church, Va., on November 5, 1892, the caterpillars of this butterfly were exceedingly abundant, being present by hundreds on sassafras bushes, which they were defoliating. This is a very late date for these caterpillars to be feeding.

Just before changing to the chrysalis the caterpillar shrinks considerably and turns a dirty yellow or dull orange.

Chrysalis.—The chrysalis is easily distinguished from the chrysalids of our other swallowtails by its smoothness combined with the occurrence of a slight but distinct ridge running the entire length of the body on either side. In color it is either green or mottled gray and brownish.

PAPILIO TROILUS ILIONEUS Abbot and Smith

FLORIDA SPICEBUSH SWALLOWTAIL

Rarely specimens of the spicebush swallowtail are taken in which the submarginal spots of both wings are much enlarged. Such individuals are in flight conspicuously different from the usual form. A typical example was taken at Cabin John on August 25, 1929, and another, not quite typical, was taken at the same place on August 9, 1931.

These specimens seem to be referable to the subspecies *ilioneus* of eastern Florida and Georgia, the northern limit of which in the coastal plain has not been determined.

PAPILIO POLYXENES ASTERIAS Fabricius

PARSNIP SWALLOWTAIL

Plate 40, Figure 2; Plate 41, Figures 1, 2; Plate 42, Figures 1, 2; Plate 43, Figures 1, 2; Plate 44, Figure 1

Occurrence.—Common throughout the District and the surrounding country, showing but little fluctuation in numbers from year to year.

In contrast to our other common local swallowtails, the parsnip swallowtail is a butterfly of open country and does not enter woods. It is particularly common in fields and meadows with an abundance of wild carrots on which chiefly in this region its caterpillars feed, and is always to be found about farms and gardens where parsley, carrots, parsnips, or celery are grown.

Habits.—The parsnip swallowtail is a butterfly of rapid and irregular flight, always keeping near the ground and seldom rising more than a foot or so above the grass tops. It often doubles on its course, and it pauses frequently to sip the nectar from a clover or a thistle blossom, which usually it does, particularly the male, without abating the nervous motion of its wings. When alarmed it dashes away wildly at great speed, darting from side to side and up and down, though scarcely rising above its usual level. Generally speaking the actions of the parsnip swallowtail resemble more nearly the actions of a large open country pierid than they do the actions of our other swallowtails.

The males are fond of resting on the summit of a tall weed with their wings extended horizontally and the fore wings drawn well back. When thus engaged they are always alert, seldom allowing one to approach closer than 6 or 8 feet.

Small hills or elevations with barren or rocky summits, especially if they be capped by a few trees, have an irresistible attraction for this butterfly. Here it loves to congregate and play about. Here it usually flies higher than is its habit when coursing over open country, and here its flight is less irregular. Where there are no hills it flies in the same way about isolated groves of trees, or along the borders of woods, or over barren areas, passing swiftly back and forth from 3 to 5 feet above the ground. It seems to mate chiefly or solely in these regions, seldom or never in the open fields.

Sometimes over a hilltop a pair of these butterflies may be seen fluttering about each other quite after the fashion of the yellow clover butterfly (*Colias philodice*), slowly rising upward. In this fashion I have seen them rise to a height of more than 50 feet before descending.

In rolling country the males are always much more numerous than the females in the higher regions, while in the lower the females are relatively more abundant.

The parsnip swallowtail is very fond of flowers, and is a very common visitor to clover fields and gardens. In gardens it sometimes proves a nuisance, as was shown some years ago when complaint was made to the Department of Agriculture that verbenas were being ruined by these butterflies pulling them all to pieces when they withdrew their tongues.

While this butterfly is sometimes seen fluttering in a leisurely manner over muddy spots in roads and barnyards, as a rule it keeps rather strictly to the fields and meadows where only, apparently, it feels secure.

The males are more active and more restless than the females, and have a more rapid and irregular and also somewhat higher flight. When feeding they usually, though not always, keep their wings in motion, while the females more frequently rest with partially extended wings. As in the case of the yellow swallowtail, the males are prone to wander and may even be rather frequent in areas where females are seldom or never to be found.

Broods.—In the vicinity of Washington this butterfly is two brooded, the first brood appearing in the second week of May and continuing to emerge into early June, becoming scarce after the middle of June and disappearing toward the middle of July. The males appear a week or more before the females. The individuals of the second brood begin to appear early in July, but do not become abundant until the end of the month; they continue on the wing until the middle of September, and occasional individuals may be found until the middle of October.

There is less difference between the butterflies of the first and the later brood than is the case with the other local swallowtails. There is no appreciable difference in size, and some, at least, of the several varietal forms seem to be relatively as common in one brood as in the other.

Local varietal forms.—Within the District the males of the parsnip swallowtail occur in three main types, one of which is abundant, one fairly common, and one rather rare. Between these three types intergrades are found.

In the most abundant form (pl. 41, fig. 1) the spots of the inner row of the fore wings are triangular with the bases outward, close together, and the apices pointing inward. The lowermost spot is elongated with the ends rounded, and that just above is large, thickly crescentic, or trapezoidal with the outer border notched. There is commonly a narrow yellow dash across the end of the cell in the fore wings; while this is often absent it is occasionally broad and conspicuous.

On the hind wings the inner series of yellow markings takes the form of a yellow band crossed by black veins, the black scaling on the vein delimiting the end of the cell being especially broad. This band begins with a spot, which varies from about as broad as long to only half as broad as long, the outer edge of which lies just under, or just within, the inner end of the lowest spot on the fore wing. The inner border of the band runs in a practically straight line to a point on the abdominal margin above the anal ocellus and about as far distant as the longest diameter of the latter, thus crossing the cell; its outer border is strongly curved, almost parallel to the row of submarginal yellow lunules, and ends at the same point above the anal ocellus. The end of the cell lies usually at the center of the yellow band. The yellow band on the hind wings is more conspicuous than the corresponding row of spots on the fore wings.

The band on the hind wings is somewhat inconstant in position. Though most commonly the end of the cell lies in the middle, the band may move basally so that it crosses very broadly the end of the cell (pl. 40, fig. 2), the yellow patch within the cell being as long as the width of the cell, and there being but one or two small spots, or even none at all, outside of the cell.

More frequently the band is somewhat narrowed through the inner border of the uppermost spot sloping outward instead of inward, the inner edge of the uppermost spot making an obtuse angle with the straight line running from the lower inner angle of the first spot to the abdominal margin, which in this case crosses only the extreme outer portion of the cell, the yellow patch within the cell being scarcely half so broad as the portion of the band beyond it.

In this most frequent form there is usually a complete line of indistinct and hazy blue spots between the submarginal yellow lunules and the yellow band, and the uppermost lunule is crossed in the middle by an orange band.

The black dot in the orange spot at the anal angle is very variable in size. It is commonly about one-third the diameter of the orange spot, but may be so large that it is bordered anteriorly only by a narrow orange band changing to yellow posteriorly, or it may be reduced to a few black scales, or even be wholly absent.

While in the males all the yellow markings on the upper surface are usually light clear yellow, they are not infrequently more or less deep ochreous.

In worn and faded individuals all the spots on the fore wings become chalky white and finally translucent, while the yellow band on the hind wings becomes ochreous.

The fore wings in the males vary considerably in shape. They are usually twice as long as broad with the costal border moderately or even only slightly curved in the basal two-thirds and the outer border nearly or quite straight, but occasionally they are considerably more than twice as long as broad, with the costal border strongly curved and the outer edge concave.

In the second form of the male (pl. 42, fig. 2) the yellow spots on the fore wings are greatly enlarged and broader than the space between them and the submarginal yellow spots, the lower ones very much so. They are strongly rounded or angled exteriorly, and the inner ends are truncated or rounded. In the first form these spots are about as long from base to apex as the distance between their bases and the submarginal yellow spots.

The yellow band on the hind wings is about twice as broad as in the common form, the uppermost spot being about twice as broad as long. In spite of this, so great is the enlargement of the yellow spots on the fore wings that the amount of yellow on the fore and hind wings seems evenly balanced instead of there being an excess of yellow on the hind wings as in the usual type. In flight the difference between this and the preceding form is very conspicuous. Like the other, this form occurs in both a clear light yellow and an ochreous phase. The blue spots on the hind wings are absent or the one nearest the anal ocellus, and sometimes the next also, is faintly indicated.

In the third form (pl. 42, fig. 1) the spots of the inner row on the fore wings are reduced in size and widely separated at the base. The lowest is a broad dash, the next is crescentic, and the remainder are triangular. They are not half so long from base to apex as the distance separating them from the submarginal spots.

On the hind wings the uppermost spot is only half as broad as long, and the yellow band, which is continuous with the row of yellow spots on the fore wings, is scarcely more than half the usual width, there being only a very small spot of yellow, or even none at all, within the cell. The blue markings on the hind wings resemble those in the common form.

Although the second form, with the extended yellow markings, is rather rare, the third, with the yellow markings much restricted, is not uncommon.

An individual caught in the District (pl. 43, fig 2) resembles the first form, but on the hind wings there is no yellow in the cell above or below, so that the yellow band is narrowest in the middle.

In another individual (pl. 43, fig. 1) the submarginal yellow spots on the fore wings are enlarged; a conspicuous yellow bar crosses the end of the cell on the fore wings; there is no yellow in the cell of the hind wings; all but the last two of the submarginal spots on the hind wings are orange, the depth of color decreasing posteriorly; the anal ocellus is without the central black dot; and all the yellow markings are darker than usual. In this individual the fore wings are rather short.

In an otherwise normal individual there is no trace of black in the anal ocellus.

A number of other variants have been described, but have not been found within the District. In one of these (*calverleyi*) the yellow triangular spots on the fore wings are extended outward and fused with the submarginal spots, and the hind wings are almost entirely yellow, tinged with orange. In another the fore wings are wholly black, with no trace of yellow. These, and others, are likely to be found at any time in this vicinity.

The great majority of the females fall into one or other of two types.

The commonest females (pl. 41, fig. 2) are grayish black. The spots of the inner row on the fore wings are represented by the first four, much reduced, with traces of the other three. On the hind wings the uppermost spot is large, the second is much reduced, and from one to three preceding the last, or sometimes all, are more or less developed. Rarely all the yellow spots of the inner row, except for the first and last on the hind wings, are absent.

Frequently females are found which are deeper black and have all the spots of the inner row present and well developed, and in addition a conspicuous yellow bar across the end of the cell of the fore wings.

Caterpillar.—The caterpillar, which is the common parsley worm of gardens, is bright green, each segment with a broad black band punctuated with conspicuous bright yellow spots across the middle and narrowly edged anteriorly with black.

It feeds on a very large variety of umbelliferous plants, including even the most poisonous, such as the poison hemlock (*Conium maculatum*). In the District it feeds chiefly on the wild carrot and on cultivated parsley, carrots, parsnips, and celery, to which it sometimes does considerable damage. It has only very rarely been found feeding on plants of other groups.

Chrysalis.—The chrysalis has a rugged and rugose surface, and the anterior half is bent backward at a considerable angle, whereby it is readily distinguished from the chrysalis of the yellow swallowtail. It is distinguished from the much larger chrysalis of the giant swallowtail (*Papilio cresphontes*) by its more slender build, less strongly curved ventral profile, and the absence of a prominent compressed tubercle at the base of the antennae. In color the chrysalis is dingy mottled brown, sometimes with dark-green markings. E. J. Smith once showed me two chrysalids that were wholly bright yellowish green.

Remarks.—This species scarcely differs except in color from the Old-World *Papilio machaon.* I am familiar with both in life, and I can not see that the habits of the two differ in the slightest degree. Furthermore, the odors of the males are the same.

The variability in the size of the yellow markings, especially in the males, seems to indicate a form that is in a state of unstable equilibrium, a black species belonging to a group the normal color of which is yellow and showing a constant tendency to revert toward the fundamental yellow color type. In other words, I believe that the variability in this species is of the same nature as, although much less extreme than, the variability in the allied *P. bairdi.* In both species the variability shows very considerable geographical variation. Comparable instability in the color pattern is shown in the dark females of the yellow swallowtail (*P. glaucus*), which also is subject to geographical variation.

PAPILIO MARCELLUS Boisduval

ZEBRA SWALLOWTAIL

Plate 48, Figures 1, 2; Plate 49, Figures 1, 2

Occurrence.—Formerly abundant, but now local and not common. It is found in some numbers early in spring in the open woods along the canal from Cabin John to Great Falls, and in summer it occurs both in the woods and in the adjacent open fields, but in lesser numbers. In summer it is an occasional visitor to gardens in Georgetown, Cleveland Park, Chevy Chase, Silver Spring, and elsewhere in the immediate vicinity of Washington. Late in summer it becomes very scarce.

It is abundant in many localities not far from the District both in Maryland and in Virginia.

This is a butterfly primarily of unkept fields grown up to brush, of bushy pastures, and of open woods with more or less extensive clearings. In the District and immediately adjacent areas recent improvements have almost completely done away with this type of country, resulting in a great decrease in the numbers of this butterfly.

The Schönborn collection includes 13 specimens dated April 8, 10, and 25, 1882, June 8, 11, and 13, and September 12, 13, and 16, 1885, two pupae, and one pupal skin labeled as having given forth the butterfly September 4, 1881.

Mr. Shoemaker has specimens taken in spring, in July, and in September.

Habits.—Early in spring the zebra swallowtail is seen coursing through the woods with a swift and direct flight, the wings in constant rapid motion, 3 or 4 feet above the ground. It is very shy and dodges from its course at the least alarm. It is very fond of flowers, especially of those of various blueberries, and will even feed on such as are not more than 3 or 4 inches from the ground and more or less concealed by leaves, searching them out somewhat after the manner of the cybele (*Argynnis cybele*).

The large summer individuals are in their habits quite different from their smaller parents. Their flight is more leisurely, less hurried, and less nervous with less rapid wing beats, and they wander more or less from side to side, sailing from time to time. They stray widely over fields and gardens and are often to be seen sailing about over muddy spots or sitting on the mud with their wings half raised.

At all seasons this butterfly is extremely fond of flowers, and great numbers sometimes may be seen where it is common about a flowering bush, restlessly visiting the flowers, stopping at each for an instant.

There is an extraordinary similarity of habit between the summer form of our zebra swallowtail and *Papilio podalirius* of southern Europe and northern Africa, as I have seen it in the south of France, and between the spring form and the brown and green *Papilio sarpedon* of eastern Asia, as I have seen it in Japan.

Seasons.—The zebra swallowtail first appears about the last week in March, before the food plant has begun to put forth its leaves, becomes common in the first week in April, and remains on the wing until late in May. The females seem to appear simultaneously with the males. A second brood appears in the first week in June, and from that time on there is a continuous succession of fresh individuals until the autumn cold puts an end to their activities, usually between the middle and end of October.

There are 2, 3, or in some cases 4 broods a year, depending on the ancestry of particular individuals at the end of the season. The spring individuals are from overwintering chrysalids derived from all the broods of the preceding summer, even including the first, so that some of the spring individuals may be considered as representing a single annual brood.

Forms.—Early-spring individuals (form *marcellus;* pl. 49, figs. 1, 2) are small with the fore wings from 33 mm. to 37 mm. (usually about 35 mm.) in length. The fore wings are short, the outer margin being almost or quite at right angles with the lower margin. The hair on the front of the head is abundant and long, forming a conspicuous tuft. The borders of the hind wings are deeply scalloped and the tails are relatively short. The dark markings are restricted and the pale bands are broad. On the fore wings the second dark band, which runs from the costal margin to the lower border, includes a conspicuous light stripe which crosses the cell. On the hind wings the inner light band almost reaches the red spot at the anal angle, which last is large and is shaped like a broad **S**. There is no light stripe along the abdominal fold. Only the extreme tip of the tail is white. This form flies until about the last of May, but becomes scarce after the middle of May.

At the end of the first week in April slightly larger individuals (form *telamonides*) appear and slowly increase in numbers. In these the wings are somewhat longer, the black markings are slightly more extensive, and the outer portion of the tails is conspicuously bordered with white, which extends more than halfway to the base. This form flies with the preceding, becoming relatively more abundant, until about the last of May.

Early in June the first individuals of the summer form (form *lecontei;* pl. 48, figs. 1, 2) appear. These are large, with the fore wings from 39 mm. to 48 mm. in length. The hair on the front of the head is short and does not form a conspicuous tuft. In the fore wings the outer and lower margins make an obtuse angle with each other. The hind wings are much less deeply scalloped than in the early-spring form and the tails are much longer. The dark markings are extended and the outer half of the hind wings is mostly or wholly black. The pale stripe crossing the cell included in the second dark band on the fore wings is absent, or only faintly indicated. There is a conspicuous pale stripe along the abdominal fold. The first and last of the submarginal yellow lunules on the hind wings are usually much reduced or vestigial. The red spot at the anal angle is merely the inner half of the corresponding spot in the spring form, with sometimes (in some males) a small isolated red spot beyond it. The white margin of the tails extends almost to the base. This form flies until the end of the season. The largest individuals are found from the latter part of July until October.

It may be pointed out that in all the other swallowtails, with the single exception of the parsnip swallowtail (*Papilio polyxenes*), the earliest spring individuals are much smaller than those emerging later, which approach, or even equal, summer individuals in size, while in the yellow clover (*Colias philodice*), the cabbage butterfly (*Pieris rapae*), and the common blue (*Lycaenopsis argiolus pseudargiolus*) late-spring individuals resemble those of the summer broods, and not those emerging earlier, in size and color.

Caterpillar.—The full-grown caterpillar is about 2 inches in length and is broadest at the third segment behind the head, thence tapering to the hinder end. It is pea green with a broad black transverse band on the dividing line between the third and fourth segments and very narrow dark transverse lines or rows of spots on all the segments. There are no eye spots in advance of the dark band.

The caterpillar feeds upon the papaw (*Asimina triloba*).

Chrysalis.—The chrysalis is smooth, short and stout, either bright green or brown in color. The abdomen is not expanded laterally, and the ventral surface is nearly straight.

Remarks.—In 1929 and 1930 this butterfly, so far as I have been able to learn, was not to be found anywhere in the District area after the first week in May, but in 1931 it was more numerous than it had been for many years, occurring in the vicinity of Cabin John throughout the summer.

Though I have found many of the eggs of this species on papaws at Cabin John in spring, I have never seen the caterpillars here.

NOTE

In addition to the species of Papilioninae considered in the preceding pages, *Papilio palamedes* (see p. 252), may possibly be found here.

Superfamily HESPERIOIDEA: The Skippers

Family HESPERIIDAE

KEY TO THE SUBFAMILIES

*a*¹. Distal recurved portion of antennal club as long as, or nearly as long as, the proximal part, the club being bent in its thickest part; abdomen shorter than the hind wings; males with a recurved fold on the costal border of the fore wings containing androconia................................ **Pyrginae** (p. 200).

*a*². Distal recurved portion of antennal club much shorter than the proximal part, or absent, the club being bent beyond its thickest part; abdomen as long as, or longer than, the hind wings; males usually with a black velvety patch on the fore wings containing androconia..................... **Hesperiinae** (p. 213).

Subfamily PYRGINAE

KEY TO THE SPECIES

*a*¹. Hind wings above entirely without white markings.
  *b*¹. Fore wings with a conspicuous yellow or brownish-yellow band, or row of large angular spots, running from the middle of the costal border toward the inner angle.
    *c*¹. Hind wings beneath with a large central silver spot (pl. 50, fig. 5)................................ **Epargyreus tityrus** (p. 202).
    *c*². No silver spot on the underside of the hind wings.
      *d*¹. Fore wings above with a continuous regular lustrous golden band running from the middle of the costal border almost to the inner angle; hind wings beneath mottled, without white (pl. 50, figs. 3, 4).
Cecropterus cellus (p. 204).
      *d*². Fore wings above with an interrupted and irregular dull brownish-yellow band, or row of large angular spots, which ends abruptly about two-thirds of the distance from the costal border to the inner angle; hind wings below with the outer third heavily washed with white (pl. 50, fig. 6)...................... **Achalarus lyciades** (p. 203).
  *b*². Fore wings without conspicuous yellow or brownish-yellow markings.
    *c*¹. Wings above brown, the fore wings mottled or plain, often with angular white spots; fore wings more than 15 mm. long.
      *d*¹. Fore wings above plain brown with a few angular white or whitish spots which may be small and widely scat-

tered, or may form a narrow interrupted band running from the middle of the costal border toward the inner angle.

e^1. Fore wings crossed by a conspicuous narrow interrupted band of white or silvery spots running from the middle of the costal margin to near the inner angle (pl. 31, figs. 2, 3) ---------------- Thorybes daunus (p. 205).

e^2. Spots on the fore wings dull, small, inconspicuous, and widely separated, not forming a band across the wings (pl. 31, fig. 4) -------------- Thorybes pylades (p. 204).

d^2. Fore wings above mottled.

e^1. Fore wings with no subapical glassy spots.

f^1. Smaller, the fore wings rarely more than 17 mm. in length; a distinct hoary patch between the upper halves of the two bands crossing the upper surface of the fore wings; male with a long pencil of hairs on the hind tibiae; costal fold of males with flagellate tapering scales (pl. 52, figs. 4–6).
Thanaos icelus (p. 210).

f^2. Larger, the fore wings rarely less than 17 mm. in length; no distinct hoary patch between the upper halves of the two bands crossing the upper surface of the fore wings; males without a pencil of hairs on the hind tibiae; costal fold of males with twisted ribbonlike scales (pl. 52, figs. 1, 2).
Thanaos brizo (p. 211).

e^2. Fore wings with subapical glassy spots.

f^1. Size smaller; fore wings rarely more than 17 mm. long; costal fold of males with many rodlike subequal androconia, sometimes 2-pronged, apically not twice as stout as basally.

g^1. Dark spots on the upper surface of the wings well defined and in striking contrast to the ground color; costal fold of males with many "apple seed" androconia (pl. 52, figs. 10–12).
Thanaos martialis (p. 212).

g^2. Dark spots on the upper surface of the wings ill defined and not in striking contrast to the ground color; costal fold of males without "apple seed" androconia (pl. 52, figs. 8, 9).
Thanaos persius (p. 211).

f^2. Size larger; fore wings seldom less than 17 mm. in length; costal fold of males with no rodlike subequal androconia, the nearest being much more than twice as stout apically as basally.

g^1. Upper surface of fore wings flecked with whitish scales throughout, so as to be quite different in general tint from the hind wings (pl. 51, figs. 4–7) ------------------------ Thanaos juvenalis (p. 212).

g^2. Upper surface of fore wings flecked with whitish scales only in small patches (pl. 51, figs. 1–3).
Thanaos horatius (p. 213).

- c^2. Uniform black with a few minute circular white dots on the fore wings; size small, the fore wings less than 15 mm. long (pl. 52, figs. 13, 14) -------- Pholisora catullus (p. 208).

a^2. Hind wings above (as well as fore wings) with large and conspicuous white markings.

- b^1. White band on upper surface of wings just beyond the middle composed of practically continuous spots each of which is much broader than, usually at least twice as broad as, high (pl. 32, figs. 2, 3) ------------------------ Pyrgus tessellatus (p. 206).
- b^2. White band on upper surface of wings just beyond the middle composed of disconnected spots, which are no broader than high (pl. 32, fig. 4) --------------------- Pyrgus centaureae (p. 205).

Genus EPARGYREUS Hübner

EPARGYREUS TITYRUS (Fabricius)

Silver-spotted Skipper

Plate 50, Figure 5

It is uncertain just what the butterfly recorded by Mr. Warden as *Papilio Tyrrhea* really was. It seems most probable that the specific name *Tyrrhea* was an error for *tityrus*.

Occurrence.—Very abundant throughout the District and the surrounding country. No other of the local butterflies is so generally distributed as the silver-spotted skipper. Though occurring everywhere from dry open fields to the deepest and dampest woods, it is most abundant where acacia trees are numerous, and about gardens near houses draped with wisteria vines.

The National Museum contains specimens from Washington, May 2, 1882 (C. V. Riley); July, 1920; bred from *Wisteria* March 23 and April 15, 1908 (F. W. Vedder); bred from *Pueraria thunbergiana* July 8, 1912 (F. H. O'Neill); a specimen collected by Schaus and Barnes; and a specimen from Anacostia, D. C. (I. J. Condit).

Habits.—The flight of the silver-spotted skipper is extremely rapid and so very irregular as to be difficult to follow with the eye. It is the most energetic and the strongest on the wing of all the local butterflies. But it has no great powers of endurance, and its flights are rarely very long. It differs from all our other skippers in flying high above the ground, usually from 2 to 4 feet, but sometimes as much as 10 feet or more.

It is very fond of flowers, especially of the lilac and syringa, the milkweeds, Japanese honeysuckle, butterflyweed, buttonbush, and clover. It has a curious preference for pink or red flowers. It prefers to visit flowers a yard or more above the ground, and therefore is seen more commonly in gardens and along shrubby roadsides than in the open fields, though in the summer it seems to be entirely at home on the red clover and in the early autumn on the thistles.

In damp woods it is very fond of the flowers of the Indianpipe, or ghost plant (*Monotropa uniflora*), and the nectar from these seems to make it stupid. At any rate, it never flies far if surprised while feeding on them.

When feeding, this butterfly usually holds the wings parallel above the back, but frequently, especially late in summer, it feeds with the wings partly spread and making an angle with each other of about 90°.

Seasons.—The silver-spotted skipper first appears in the latter half of April, by the end of May is very common, and by the middle of June has become abundant. In July fresh individuals of a second brood appear, and these continue to emerge throughout August, occasional fresh specimens being seen until the middle of September. The butterfly remains upon the wing in diminishing numbers until the second week in October. The period of maximum abundance is the last week in June and the first half of July.

Caterpillar.—The caterpillar is very common on acacia trees (*Robinia pseudacacia*) especially on those growing on the borders of woods, and on wisteria vines, living in a little shelter made by binding together from two to eight, usually four or six, of the leaflets of the food plant. It is greenish yellow marked with brighter green, and the dark brownish-red head is marked in front with two large rounded orange spots.

Chrysalis.—The chrysalis is formed within a crude cocoon made by binding together any materials available. It is usually formed on the ground, beneath leaves, sticks, or bits of wood. The winter is passed in the chrysalis.

Remarks.—Dr. L. O. Howard has recorded an instance of nocturnal activity on the part of this butterfly in the District. He wrote (Insect Life, vol. 5, no. 5, p. 355, July, 1893) that at 9 p. m. on June 6, after a long-continued rain, the weather being sultry, a handsome fresh male of this species entered his study through the open window.

Genus ACHALARUS Scudder

ACHALARUS LYCIADES (Geyer)

FROSTED SKIPPER

Plate 50, Figure 6

Occurrence.—Frequent throughout the District in suitable localities, though much less numerous and far less conspicuous than the silver-spotted skipper.

The frosted skipper is found especially in open fields and gardens and along the sides of roads through open woods.

Habits.—This butterfly is much less active than the silver-spotted skipper, with a less rapid and lower flight, seldom rising more than a yard above the ground. It feeds especially on clover, butterflyweed, and other low-growing plants, though often on the buttonbush and on tall garden plants.

It first appears early in May and becomes common late in May and early in June, its numbers then decreasing until the second brood appears about the first of July. This second brood seems to be only a partial brood, for the butterfly is never so common in the summer as it is in spring.

Caterpillar.—The caterpillar resembles that of the silver-spotted skipper, but has a black head and a light dorsal stripe. The body is speckled with orange dots, giving it a granulated appearance.

It feeds especially on species of beggar's lice (*Meibomia*), but also on other plants of the pea family as well as on plants of other groups.

Genus CECROPTERUS Herrich-Schaeffer

CECROPTERUS CELLUS (Boisduval and Le Conte)

Gold-banded Skipper

Plate 50, Figures 3, 4

Occurrence.—Ernest Shoemaker captured a specimen of this handsome butterfly in the District on June 25, 1889, and another at Difficult Run, Fairfax County, Va., on June 23, 1920. On July 30, 1930, Dr. G. W. Rawson and the author found an example of this species feeding on a buttonbush at Collington, Md., in a bog across the highway from the railroad station.

Remarks.—The gold-banded skipper has a wide range throughout the South, but is nowhere very common. It is to be sought for along the sides of streams and in the immediate vicinity of swamps.

Genus THORYBES Scudder

THORYBES PYLADES (Scudder)

Northern Smoky Skipper

Plate 31, Figure 4

Occurrence.—Common in suitable localities throughout the District and the surrounding country.

This butterfly especially frequents open meadows and fields with an abundant growth of clover, usually keeping fairly near the borders of the woods. It is also common in glades and clearings and along the sides of woodland roads wherever leguminous weeds abound.

It appears in the second week of May, and becomes very common in the first half of June. The numbers then decline, but it persists until about the middle of July. It reappears late in July and may be found until about the last of September. But it is much less common in summer than in spring, the second brood being apparently only partial.

Habits.—It has a strong, rapid, and highly irregular flight, keeping usually very near the ground. It is very fond of flowers early in spring, particularly those of blueberries, later especially those of the red clover. Early in July it is attracted by the flowers of the Indianpipe, or ghost plant, and the nectar from these seems partially to stupefy it.

When feeding this species holds its wings partially extended, sometimes fully extended, in contrast to the silver-spotted and the frosted skippers, which hold their wings erect and parallel.

Caterpillar.—The caterpillar much resembles those of the preceding species, particularly that of *Achalarus lyciades*, from which it differs most obviously in its very narrow neck, which is less than half as wide as the head. It feeds especially on clover and on bushclover, and also on various related plants.

THORYBES DAUNUS (Cramer)

Southern Smoky Skipper

Plate 31, Figures 2, 3

Occurrence.—Common in suitable localities throughout the District and the surrounding country, though somewhat less abundant than the northern smoky skipper (*T. pylades*).

It first appears in the second week in May, becoming common in June and flying until the middle of July. Its period of greatest abundance is the last half of June, whereas the preceding species (*T. pylades*) is most abundant in the first half of June. It later reappears, flying throughout August. Ernest Shoemaker has specimens taken on August 21, 1900. Like the preceding, it is much more numerous early than late in summer.

Habits.—This species occurs with the preceding, and the habits of the two seem not to differ to any appreciable degree.

Genus PYRGUS Hübner

PYRGUS CENTAUREAE WYANDOT (Edwards)

Grizzled Darter

Plate 32, Figure 4

Occurrence.—One of the specimens upon which W. H. Edwards based his new species *Hesperia wyandot* was taken at Washington by Mr. Drexler. Ernest Shoemaker took a specimen in Arlington

County, Va., beyond the Free Bridge, late in April, and I captured one in the woods north of the canal 1 mile west of Cabin John, Md., on April 19, 1926. There are two specimens from the District in the Schönborn collection, one taken on April 21 and the other without a date.

Remarks.—This butterfly has a curious distribution, being found in Europe in Scandinavia, Finland, and Lapland, in Asia in the Altai Mountains, and in North America in Labrador and eastern Canada, and also in a slightly different form from New Jersey southward to North Carolina, as well as in the Rocky Mountains. In Europe it extends farther northward than any other skipper, passing well beyond the Arctic Circle.

In the subarctic regions and in the mountains of Asia it flies in June and July. In this vicinity it is known to fly only in the last half of April, when the temperature is approximately the same as at the season of its flight in Labrador and in northwestern Europe.

What is the reason for the existence of this insect from New Jersey to North Carolina in a colony widely separated from any other area where it is to be found? Is it possible that the butterfly has persisted in this area since the last southward extension of the ice while to the northward it has died out as far as Quebec?

PYRGUS TESSELLATUS TESSELLATUS (Scudder)

Gray Darter

Plate 32, Figures 2, 3

Occurrence.—Frequent in moist open fields near woods and along the borders of woodland roads, and locally abundant.

I have noted single individuals of this species in several of the city parks, in the Department of Agriculture and Smithsonian Institution grounds, about Potomac Park, and in gardens and back yards throughout the city, and widely scattered individuals in the open fields west of Cabin John, mostly along the borders of the woods. But the only place where I have seen it in abundance is in the lower portion of an extensive field not far beyond the Northwest Branch at Silver Spring. A small brook bordered on each side with trees and bushes runs through this hollow, and in a band about 100 feet in width adjoining the wooded borders of this little stream this butterfly is very common.

Habits.—In its habitat at Silver Spring the gray darter is so very local that unless one happened to stray within the narrow belt along the stream where it occurs its presence would never be suspected.

On hot and sunny days the flight of the males is extremely swift, and furthermore direct, without the erratic skipping so characteristic of the flight of most of the species of this group of butterflies. They pass with amazing speed at a height of about 4 feet above the ground, darting at every insect near their path, and especially at others of their kind. When two meet they whirl about each other for a second or two, when one suddenly makes off, pursued for a short distance by the other. Sometimes three, or even four, will whirl about together, passing back and forth like a living tornado over a considerable space, then separating as suddenly as they met.

Their great speed renders them exceedingly difficult to catch, for one is no sooner seen than it has passed by. But they have two peculiarities that serve to overcome this difficulty. One is that individuals flying back and forth mostly travel in parallel lines in a relatively narrow belt, so that from a positon in this flyway they are easily intercepted. Another is that the flight of any individual is never of long duration. It quickly tires and suddenly drops down to rest on the topmost leaf of some conspicuous plant higher than those about it, or on the summit of a dead weed stalk. From this point of vantage it makes occasional vicious darts at insects passing by. When the butterfly is resting the wings are partially expanded, the hind wings making a greater angle with each other than the fore wings.

The females are rather inactive, and are much less widely distributed than the males. Their flight is low and leisurely, with a feeble skipping, and is always short.

On cloudy or cool days the males lose their energy and indulge merely in short flights, which have the skipping character of the flight of related species, though this is never very strongly marked. At such times the flight is low, never more than a few inches above the grass tops, and by no means swift, being practically identical with the flight of the females.

Individuals of both sexes are very fond of sunning themselves on leaves or weed stalks with their wings expanded to the horizontal and the fore wings drawn well back. Solitary males are sometimes seen sucking moisture from mud with their wings partly raised in the resting position.

Seasons.—I have taken this butterfly on July 24, frequently from the last week in August until toward the end of September, then in decreasing numbers until the middle of October. It is most abundant in the middle of September.

It is undoubtedly triple brooded here, the first brood, not yet reported here, probably flying from the end of April until early in June or perhaps later, the second from late in June until early in August, and the third and most abundant from late in August until well into October. Individuals are probably to be found, in varying numbers, throughout the summer.

Mr. Shoemaker has a specimen taken in the District on August 20, 1902, and Mr. Schönborn's specimens are dated August 12 and September 3. The National Museum collection contains a female collected on hollyhock by Dr. F. H. Chittenden on June 27, 1916.

Genus PHOLISORA Scudder

PHOLISORA CATULLUS (Fabricius)

Pigweed Skipper

Plate 52, Figures 13, 14

Occurrence.—Locally frequent, or even common, being found wherever the common pigweed (*Chenopodium album*) grows, and casually in open country elsewhere. It is common about farms and along roads through fields, and throughout Washington in neglected gardens and in untidy back yards and vacant lots. I have seen stray individuals in the Department of Agriculture and Smithsonian Institution grounds and in Lafayette Park.

Habits.—This little skipper is very quick in all its actions. It flies very rapidly in an irregular zigzag 3 or 4 inches above the ground, weaving its way in and out among the higher plants. It is very aggressive, and frequently attacks the much larger, but much less agile, individuals of the various species of *Thanaos*, causing them evident distress. On the other hand, I have seen one, a female which was sunning itself in the road, put to flight by a fly somewhat smaller than a house fly that suddenly lit on the ground about 2 inches to the left of it.

This butterfly pays much less attention to flowers than most skippers, and therefore appears to be less common than it really is. In feeding the wings are partially expanded. When resting the wings are partially expanded, but when sunning itself the butterfly often sits with the wings fully extended and their outer margins touching the ground.

Seasons.—The pigweed skipper appears toward the end of April, and in a few days becomes common. A second brood begins to become evident in the last half of July, and there is a third brood in August and September. Individuals are to be seen on the wing throughout the summer.

The National Museum collection contains three specimens taken by P. M. Johnson in July, 1912, in Washington, one from Washington found on July 16, 1916, on *Amaranthus*, and one from the District taken on July 27, 1899. Mr. Schönborn's specimens are dated May 3, June 4, and July 16, 1888.

Caterpillar.—The caterpillar is very pale green with a brown head, and resembles that of related skippers. It feeds especially on the common pigweed (*Chenopodium album*), but also on other plants belonging to the family Chenopodiaceae, on species of the closely allied Amaranthaceae, and occasionally on species of other families.

By bending up the two edges of a leaf and fastening them together with silk, or occasionally by binding two leaves together, the caterpillars fashion for themselves a shelter in the form of a hollow cylinder in which they live. These shelters are very easily found, and when they are opened the caterpillars are readily recognized by the pale green color, swollen dark-brown head, and constricted neck with a narrow dark brown collar.

In autumn the caterpillars simply become dormant within these shelters, which they reinforce and seal with silk. With the collapse of the food plant the shelters come to lie upon the ground.

Winter is passed as a fully fed caterpillar, which in spring changes to a pupa without leaving the flimsy structure formed in autumn. If the food plant withers prematurely the caterpillars will sometimes wander away and form a flimsy cocoon elsewhere.

Remarks.—The presence of this species in any locality is most easily demonstrated by finding the caterpillars. They are particularly numerous and easy to discover in the last half of October.

Genus THANAOS Boisduval

The butterflies of the genus *Thanaos* are remarkable for their close superficial resemblance to one another, which makes them very difficult for anyone not especially familiar with them to identify. Specific determinations, therefore, should always be checked by an authority on the group, or at least by someone thoroughly acquainted with the local species.

We need much more information than we have on the early stages of nearly all our species. Though they are not difficult to raise, the slow growth of the caterpillars makes raising them a rather tedious process.

All the species in this region, so far as known, spend the winter as fully grown caterpillars, changing to pupae without eating early in spring.

These are among the very earliest of our butterflies to appear, and are especially to be found along roads through woods growing in hilly country, about exposed rocks in woods, and about clearings. Some prefer areas covered with scattered scrub oak, and some are more or less common in open fields near woods. The individuals of the later broods are much more likely to be found in open country than are those of the spring brood.

Some species have but a single brood, some have a partial second brood, and one of ours has three broods.

The individuals of the summer brood of our local species have been found only in the open fields, whereas those of the spring brood are most abundant in the woods.

All are active and alert, but the different species show considerable variation in their habits. In all ours the males are on the wing a week or 10 days before the first appearance of the females.

These butterflies are very fond of flowers, especially those of the blueberries, wintercress (*Barbarea vulgaris*), blackberries, certain violets, and the Jersey-tea (*Ceanothus americanus*). In summer they are very partial to the flowers of the red clover.

In feeding they either hold the wings horizontally extended with the fore wings drawn well back, or the wings are slightly raised, making an obtuse or a right angle with each other. When resting on the ground they sit with the wings half raised, or fully spread out with the tips touching the ground. They are sometimes to be seen resting on a stem of a plant with the wings drawn down so as to embrace the stem and the fore wings drawn far back much after the fashion of a noctuid moth.

A curious feature of the butterflies of this genus is that the pattern of the fore wings on the two sides of the body is never quite the same, though the differences usually are slight. These are the only North American butterflies in which the wings of the two sides are not alike, or practically alike.

THANAOS ICELUS (Scudder and Burgess)

Plate 52, Figures 4 to 6

Occurrence.—Common along roadsides in woods, about exposed rocks and cliffs, and along roadsides through open fields, especially west of Cabin John, Md.

Mr. Shoemaker has found it in the District early in spring. There are four specimens from the District in the Schönborn collection, and I have it from near Great Falls, April 19, 1925, from the fields west of Cabin John, where it is common, May 11, 1930, May 12, 1929, and June 2, 1929, and from fields at Beltsville, May 30, 1929. It reaches its greatest abundance in the last half of May, about two weeks later than *T. juvenalis*.

Remarks.—This is the least active of the local species of the genus and the easiest to catch. It has a highly irregular flight, and keeps always near the ground. On the wing it greatly resembles *Pholisora catullus* with which it flies, though it is easily distinguished by its lighter color, somewhat larger size, and the longer straight dashes in its angular and highly irregular flight.

This species has only a single brood a year, flying early in spring. The caterpillar feeds on a number of different plants, but especially on willow and poplar.

THANAOS BRIZO BRIZO (Boisduval and Le Conte)

Plate 52, Figures 1, 2

Occurrence.—Mr. Shoemaker has taken this species in the District early in spring, and there are four specimens from the District in the Schönborn collection.

I have seen it in the woods between Cabin John and Great Falls, and it is especially numerous in the woods along Paint Branch.

Remarks.—This species frequents woodland roads, and open and especially rocky places in woods. While the females remain always in the shelter of the woods, the males wander out over open fields, where they are found with the much commoner *T. juvenalis.*

It flies in April and May, disappearing shortly after the middle of the latter month. It appears again in much smaller numbers in August, being here partially double brooded.

Mr. Scudder describes it as flying swiftly with frequent sudden movements from one side to the other, but always remaining about 3 feet above the ground. Here it flies rather lower, being seldom seen as much as 2 feet above the ground. It is very alert and quick, and Mr. Scudder says that it is the most difficult of all our species to capture. I have found this to be true in New England, but the relatively small individuals occurring here are less energetic than *T. juvenalis*, and do not fly so high.

The caterpillar feeds chiefly on scrub oak, though also on other plants.

THANAOS PERSIUS (Scudder)

Plate 52, Figures 8, 9

Occurrence.—I have specimens from the fields beyond Cabin John taken on April 14, 1929, June 3, 1923, and July 29, 1928. Mr. Shoemaker has one from Arlington County, Va., taken on July 9, 1908, and there are three specimens from the District in the Schönborn collection.

Remarks.—Though found along woodland roads and about rocks in woods, this species is more common in open fields than most of its relatives. Mr. Scudder says that this butterfly is fond of alighting on wet sand and may most frequently be found by shady roadsides near woods, seeming to frequent the vicinity of hazel. He describes it as flying with a strong rapid movement, especially when disturbed, and seldom passing from one spot to an adjacent one without describing several irregular and rapid circles, and says that at such a time it rarely rises more than 2 or 3 inches above the ground. He noticed that it is an uneasy insect, difficult to suit; no sooner does it alight on a choice bit of moist shady ground than off it starts again, and in alarm it shows the greatest uneasiness. According to him it usually rests on the ground with the wings fully expanded, touching the earth behind, but considerably elevated in front. When it is sipping the moisture from the surface the antennae droop at an angle of about 30° with the body. When it alights on a twig the wings are generally placed at about right angles with each other and the antennae then diverge at an angle of about 110°; but its wings are soon fully expanded, as on the ground, and then the antennae approach until they are at about right angles with each other. One may sometimes see them alight with expanded wings in the bright sunlight and then, as if it were too hot for them, raise all the wings equally until they are edgewise to the sun, or with the slightest possible divergence, the fore wings dropped a little so that the costal margin is entirely vertical.

There is a partial second brood of this butterfly in August, but this appears to consist of few individuals.

The caterpillar feeds on species of willow and of poplar.

THANAOS MARTIALIS (Scudder)

Plate 52, Figures 10 to 12

Occurrence.—Mr. Shoemaker has this butterfly from the District taken early in spring, and I have it from Cabin John; May 4 and 11, 1930, and from near Great Falls, June 17, 1923. Mr. Schönborn's specimens are dated April 20 and 29.

Remarks.—This species is found both in the woods and in open fields in the vicinity of woods. There are two broods, the second brood, in which the individuals are not so numerous as in the first, appearing about the middle of July. Mr. Lintner says that the butterflies of the second brood are more subdued in color than those of the first.

THANAOS JUVENALIS (Fabricius)

Plate 51, Figures 4 to 10

Occurrence.—This is the commonest species of the genus in the District, particular in summer.

It is to be found along the sides of woodland roads and about rocky places in woods, being most abundant in the vicinity of scrub oak; but it is also to be met with scattered widely over open fields in which there are small isolated oaks or which are bordered with oak scrub. In summer especially it seems to enjoy coursing over meadows where it feeds on the flowers of the red clover, butterflyweed, and asters. It is not infrequently seen in summer sucking moisture from muddy spots, on which it keeps always more or less aloof from the other butterflies. Very early in spring it is often seen flying about the branches of the trees 20 feet or more above the ground.

Mr. Shoemaker has taken this species in the District early in spring, and I have a considerable series of specimens from Cabin John, Great Falls, and Silver Spring taken on April 13, 14, and 23, May 25, July 18, August 6, 26, 27, and 28, and October 13.

Seasons.—This is the first of all the skippers to appear in spring. It is partially two brooded. The first brood appears in the first week of April and flies until early in June. It is most abundant in the second week in April and from then on into early in May. The individuals of the second brood appear irregularly over a long period from about the middle of July until the middle of October, flying until cold weather. Though very common in spring, this is a rather scarce butterfly in summer.

Caterpillar.—The caterpillar feeds on oak, especially on scrub oak, and sometimes on other plants, particularly those of the pea family (Fabaceae).

THANAOS HORATIUS (Scudder and Burgess)

Plate 51, Figures 1 to 3

Occurrence.—Mr. Scudder recorded a specimen of this species from the District in the Yale Museum which was taken by Mr. Dodge, and Mr. Shoemaker has taken it within the District. I have specimens taken in the fields beyond Cabin John and at Silver Spring on April 14, July 15, 18, and 24, and on August 16.

Remarks.—Except for *Thanaos juvenalis* and *T. icelus*, this is the commonest species of the genus in the District, and also the commonest in open fields, especially in summer. It is two brooded, flying from about the middle of April until June, and again from the middle of July until about the first of September.

NOTE

In addition to the species of Pyrginae treated in the foregoing pages, the following are to be looked for here:

Goniurus proteus (see p. 252).
Thanaos lucilius (see p. 253).
Thanaos terentius (see p. 253).
Staphylus hayhurstii (see p. 253).

Subfamily HESPERIINAE

KEY TO THE MALES OF THE SPECIES

*a*¹. Club of antennae not produced at the tip nor recurved; size very small; fore wings above mostly brown, hind wings dull golden margined with brown; beneath, fore wings blackish broadly margined with dull golden, hind wings plain dull golden (pl. 3, fig. 9) __________________ Ancyloxypha numitor (p. 217).

*a*². Club of antennae with a distinct, though sometimes slight, recurved terminal hook.

- b^1. Wings plain brown above and below, wholly unmarked; size small (pl. 3, fig. 8) ---------------------- **Megistias fusca** (p. 232).
- b^2. Wings never entirely without markings.
  - c^1. Wings above blackish brown, entirely unmarked; hind wings beneath dark rusty with a sharply angled yellow band having a broad yellow dash through the angle; fore wings beneath black with a narrow dark rusty border; both fore and hind wings broadly rounded (pl. 53, figs. 1–12) ---------------------------- **Poanes massasoit** (p. 225).
  - c^2. Colors not as above.
    - d^1. Hind wings beneath uniform deep yellow; fore wings the same, becoming dark brown near the inner border; above golden yellow with a narrow brown border (pl. 19, figs. 4–9) -------------------- **Atrytone logan** (p. 223).
    - d^2. Hind wings beneath not uniform yellow.
      - e^1. Fore wings above mainly yellow with a dark border; hind wings above yellow with a dark border, or yellow brown with long obscure streaks of yellow.
        - f^1. Fore wings within the brown border unmarked.
          - g^1. Hind wings below mostly clear light yellow with a curved red-brown band delimiting the basal fourth and some slight brownish spots or marks along the outer border (pl. 54, figs. 7–10) ------------------ -------- **Poanes zabulon** (p. 230).
          - g^2. Hind wings below with the central portion broadly yellow, the basal third and a broad border red-brown, the latter dusted with hoary (pl. 54, figs. 13–16) ----------------- **Poanes hobomok** (p. 230).
        - f^2. Fore wings with a conspicuous black patch in the center.
          - g^1. Hind wings yellow with a dark-brown border.
            - h^1. Black patch on the fore wings a narrow dash; dark border of wings crenulate; no black spot above the outer end of the black patch (pl. 21, figs. 8, 9) ------------------- **Erynnis sassacus** (p. 219).
            - h^2. Black patch on the fore wings appleseed shaped; dark border of wings deeply and sharply angular; a black dash above the outer end of the black patch (pl. 53, figs. 13, 14). **Hylephila phylaeus** (p. 220).
          - g^2. Hind wings of the same color as the border of the fore wings, with more or less obscure long radiating streaks; black patch on fore wings very large and oval (pl. 35, fig. 2). **Atalopedes campestris** (p. 222).
      - e^2. Fore wings mainly dark brown, plain or more or less extensively marked with yellow or white.
        - f^1. Hind wings above with yellow or white spots.
          - g^1. Large and robust, the fore wing about 25 mm. long; above brown, marked on the fore wings with 6 or 7 conspicuous white spots, and on the hind wings with a row of 3 white spots (pl. 50, figs. 7, 8) --------------------------- **Calpodes ethlius** (p. 233).

*g*². Size medium or small, the fore wing not more than 22 mm. long; wings marked with yellow above.

*h*¹. Hind wings below with the yellow spots much larger and lighter than on the upper surface, and also more numerous, there being a cluster of large spots, or a large irregular patch, in the basal half of the wing; size small, the fore wing 13 mm. long or less (pl. 49, figs. 8–11). **Polites coras** (p. 220).

*h*². Spots on hind wing beneath not more extensive than on upper surface; no additional light spots below; rather large, the fore wings at least 15 mm. long.

*i*¹. Hind wings beneath dark gray with a broad more or less obscure light band running from the base to the outer margin, and some light spots near its outer end; fore wings about 20 mm. long (pl. 20, fig. 3). **Poanes viator** (p. 229).

*i*². Hind wings beneath brown or cinnamon, without a broad light central band; size smaller.

*j*¹. Hind wings below bright cinnamon with an angled row of clearly defined light spots in the outer fourth of the wing and an isolated spot in the cell; discal stigma on fore wings above inconspicuous (pl. 16, figs. 5, 7) -------------- **Erynnis leonardus** (p. 218).

*j*². Hind wings below brown, with the spots above repeated indefinitely, with obscure outlines; discal stigma on fore wings conspicuous (pl. 54, figs. 1–6) - **Atrytone pontiac** (p. 224).

*f*². Hind wings above brown, unmarked.

*g*¹. Fringes of wings conspicuously alternating dark and very light; above dark brown, the fore wings with two or three (rarely more) minute white spots near the costal margin; hind wings below dark brown, slightly mottled, clouded with pale bluish scales, especially in the outer third (pl. 52, figs. 17, 18) ---- **Amblyscirtes vialis** (p. 231).

*g*². Fringes of wings uniform in color.

*h*¹. Fore wings with a few small white spots.

*i*¹. A conspicuous white spot just beyond the middle of the fore wing, with another smaller spot beyond it and some minute spots above the latter; outer border of fore and hind wings slightly concave in the middle (pl. 8, fig. 8) ------------------------ **Prenes ocola** (p. 233).

*i*². No conspicuous white spot near middle of fore wing; three minute white spots near costal border in outer third of wing, and another some distance beneath these; border of fore and hind wings convex.

j^1. Hind wings beneath brown, becoming hoary gray in the outer half; a small but conspicuous white circular spot near the base, and usually another, smaller, beyond it; discal stigma very obscure (pl. 14, figs. 4–6) ____________ **Atrytonopsis hianna** (p. 231).

j^2. Hind wings beneath very dark brown, slightly clouded with lighter; no white spots; discal stigma on fore wing above slender and gently curved, and easily seen; head with an ocellus, or simple eye, in the middle of the front (pl. 53, figs. 17, 18) ____________________ **Lerema accius** (p. 232).

h^2. Fore wings without white spots—unmarked or with tawny or yellowish markings.

i^1. Fore wings with the cell and costal border above tawny, the tawny patch bordered below, at least outwardly, by the discal stigma.

j^1. Discal stigma broad, short, and sinuous (pl. 49, figs. 5, 6) _______________ **Polites cernes** (p. 222).

j^2. Discal stigma slender, elongate, and almost perfectly straight (pl. 49, figs. 3, 4). **Polites manataaqua** (p. 221).

i^2. Fore wing with the cell and costal border above of the dark-brown ground color of the wings.

j^1. Discal stigma on fore wing continuous.

k^1. Upper surface unmarked except for the blackish discal stigma (pl. 21, figs. 4, 5). **Atrytone vestris** (p. 224).

k^2. Upper surface of fore wings with yellow spots; a small elongated yellow spot on the outside of upper end of stigma; just below this, separated from it by a dark vein, a much larger spot; at the lower end of the stigma, well separated from the preceding spot, a broad short dash; an obscure dash just before the middle of the inner border, and another in the cell; three minute spots near the costal border halfway between the stigma and the apex (pl. 49, fig. 7) ____ **Polites verna** (p. 221).

j^2. Discal stigma on fore wings broadly interrupted, consisting of an elongate oval upper and very small more or less circular lower and inner portion; a short broad tawny dash running out from the outer end of upper portion of stigma, above the outer end of which, near the costal border, are from one to three minute elongated spots (pl. 21, figs. 6, 7) ____ **Catia otho** (p. 223).

Genus ANCYLOXYPHA Felder

ANCYLOXYPHA NUMITOR (Fabricius)

LEAST SKIPPER

Plate 3, Figure 9

Occurrence.—Abundant. In spring and early in summer the least skipper is rather local and is found only in wet, grassy areas, especially along the marshy, grassy banks of small brooks flowing through meadows or through woodland glades. In midsummer it is much more widely distributed, and late in summer it is to be seen in greater or lesser numbers in almost all grassy regions.

In midsummer and late in summer it is occasionally to be observed in the Smithsonian Institution and Department of Agriculture grounds and in Potomac Park.

The National Museum contains a specimen taken by I. J. Condit on August 6, 1906, one caught by Dr. Harrison G. Dyar in September, a very large female with the fore wing 14 mm. long taken in July, 1919, and another without date, all from Washington, and a pupa taken by Dr. H. G. Dyar also in Washington in September.

Habits.—Wherever it occurs the least skipper is abundant, though on account of its small size and retiring habits it is likely to be overlooked.

Mr. Scudder wrote that this butterfly has a feeble flight, never darting about from one spot to another like other skippers, but moving in a leisurely languid manner, skipping over the grass tops of a lane or among the reeds of a marshy rill in the most dainty manner possible. He noted that it does not turn much to one side or the other, but flies with a short slight vertical movement, apparently giving but a single beat of its wings to each little skip, and frequently stopping to alight. It seldom rises above the grass tops, and when alarmed, as noted by Maynard, often drops into the grass and there conceals itself.

It is very fond of flowers, feeding especially on those of small low-growing plants which do not rise above the grass tops.

Mr. Scudder has remarked that when at rest this butterfly has the curious habit of moving its antennae in a small circle, the motion of the two alternating, that is, when one is moving in a forward curve the other is passing in a reverse direction. But this habit is not peculiar to this skipper. I have noticed that *Atrytone logan* when held in the fingers will do the same thing.

Broods.—The least skipper is three brooded. It appears just before the middle of May and becomes abundant toward the end of May and in June, but disappears before the first of July. It reappears in the middle of July, remains common until after the first of August, gradually becomes less numerous and very nearly disappears by the middle of the month, shortly after which fresh individuals again are on the wing. The interval between the disappearance of the second brood and the first appearance of the third brood is very short, and is perhaps completely bridged by some of the individuals of the second brood. The butterfly is to be found until the second week in October.

Genus ERYNNIS Schrank

ERYNNIS LEONARDUS (Harris)

Leonard's Skipper

Plate 16, Figures 4 to 9; Plate 17, Figures 3 to 6

Occurrence.—Frequent, but not very common, in damp meadows. It is found in the damp fields between Conduit Road and the canal beyond Cabin John, and in similar localities at Silver Spring and elsewhere. Mr. Shoemaker has this butterfly from Montgomery County, Md., September 19, 1911, Arlington County, Va., September 16, 1901, and Fairfax County, Va., September 22, 1920.

Season.—Leonard's skipper has but a single brood a year. It appears on or about the first of September and slowly increases in numbers until about the middle of the month, after which its numbers decline and it has usually disappeared before the first of October. The males appear from a week to 10 days in advance of the females, and by the time the females have become common the males are mostly rubbed and worn.

Remarks.—At the height of the season, about the third week in September, half a dozen or so of these fine skippers may be secured in a day in the most favorable localities, but in most of the places where they are found from one to three or four will be met with in the course of a day. Up to the middle of September females are relatively scarce, but in the last half of the month they outnumber the males and toward the first of October only females are to be found.

This is one of the handsomest and most conspicuous of our local skippers. It feeds almost exclusively on flowers from 3 to 6 feet above the ground and standing well above the surrounding herbage, and is very seldom seen on any but purplish pink flowers. It is therefore very rarely observed except on thistles and on joe-pye-weed (*Eupatorium purpureum*), although I have once or twice taken it on asters. So far as I have seen it always feeds sitting on the flower heads with the body horizontal. Though most of the other skippers feed by preference in this attitude, they will on occasion, especially the larger ones, feed with the body more or less vertical.

On the thistle heads it is interesting to contrast the varied positions of *Atalopedes campestris*, *Polites coras*, *P. cernes*, and *Epargyreus tityrus* with the unvarying attitude assumed by Leonard's skipper.

This species is shy and suspicious, and when alarmed darts off from its elevated perch at any angle, so that, its small size considered, it is exceptionally difficult to capture. As is the case with most small skippers, it is quick to discover small holes in a net, and very adept in escaping through them.

Its flight is rather high, and it is often seen coursing about a foot or so above the grass tops in the usual irregular angular fashion of a skipper. The flight seems to be less rapid than the flight of other skippers of corresponding size, such as *Atalopedes campestris* or *Prenes panoquin*, but this may be due to the fact that because of its color and because of the height at which it flies it is more easily followed by the eye.

In 1930 this butterfly was observed in numerous localities in the vicinity of Boston, Mass., where it appears just before the middle of August and reaches its maximum abundance in the last week in August, after which an increasing proportion of the individuals are worn and faded and the numbers decrease.

About Boston it is common in damp meadows. Three or four may often be seen playing together 5 or 6 feet above the ground, and in favorable localities a dozen or more may be taken on the joe-pye-weed in the course of an hour.

After observing this species during the period of maximum abundance about Boston, I returned to Washington and made corresponding observations during the period of maximum abundance here nearly three weeks later. The relative scarcity of this insect in the vicinity of the District is very striking.

Notes.—The underside of the hind wings in this species is subject to considerable variation. In some males the ground color is deep cinnamon with the spots reduced to small dots, while in a male from Newton, Mass., the ground color is light buff with the spots greatly enlarged and confluent, forming a broad angled band.

ERYNNIS SASSACUS SASSACUS (Harris)

INDIAN SKIPPER

Plate 21, Figures 8, 9

I have a specimen of the Indian skipper, unfortunately without date, taken in a moist meadow near the canal beyond Cabin John.

Genus HYLEPHILA Billberg

HYLEPHILA PHYLAEUS (Drury)

Plate 53, Figures 13, 14

Occurrence.—Frequent in moist meadows. In the Schönborn collection there are two males and two females taken on August 12 (2) and 13, and on September 3, and I have a pair taken at Silver Spring on September 2, 1927, and three males taken at Cabin John on September 23 (2) and October 13, 1928.

It is common only in the Department of Agriculture grounds, where it is to be seen in numbers about the flower beds in summer. On August 12, 1929, it was particularly abundant about the heliotrope and in the space of a few minutes' time I caught three fresh females with my fingers. Dr. G. W. Rawson and Harold H. Shepard have told me that they have seen it in numbers about these beds.

In this region this species should occur in May as well as late in summer and early in autumn.

Remarks.—This skipper has a very rapid sharply zigzag flight with relatively little vertical skipping, like that of the sachem (*Atalopedes campestris*) with which it flies. It keeps always near the ground or grass tops and is therefore easily overlooked. It is especially fond of the flowers of the red clover (*Trifolium pratense*) and of the mistflower (*Eupatorium coelestinum*), and is sometimes seen on asters, but it does not visit the higher flowers of the thistles, which are especially the favorites of most of the late-summer skippers. The females are less active and less shy than the males, the difference in the habits of the two sexes being greater than in the case of most of our skippers.

Genus POLITES Scudder

POLITES CORAS (Cramer)

Plate 49, Figures 8 to 11

Occurrence.—Very common in low fields everywhere. Except for the least skipper (*Ancyloxypha numitor*), this is the most abundant of the smaller skippers in this region, but it is likely to be overlooked because of its small size and its habit of keeping well down in the grass.

Mr. Shoemaker has taken it in the District, and there is a pair from the District in the Schönborn collection. The National Museum contains a female labeled "coll. Quarantine House, Washington, D. C."

Habits.—Although the two are frequently found together late in summer and in autumn, this species by preference frequents drier areas than *Ancyloxypha numitor*, and especially areas in which the grass is rather low and sparse. But it is by no means so characteristic of dry fields and barren hillsides here as it is farther north.

It is very fond of flowers, especially the flowers of small plants that do not rise above the grass tops, but it will sometimes rise to the lower flowers of the buttonbush and of the thistles.

Broods.—This little butterfly is three brooded. The first brood, in which the individuals are not very numerous, appears about the first of May, becoming most plentiful toward the end of the month and flying until the middle of June. The second brood appears very shortly after the first of July, and a few individuals of this brood are still on the wing when the third brood appears early in August. The numbers of this last brood gradually increase until about the middle of September, after which the butterflies gradually decrease in abundance, finally disappearing early in October.

It reaches its maximum abundance and widest distribution in the middle of September, when it is found in greater or lesser numbers in practically every grassy area.

POLITES VERNA (Edwards)

Plate 49, Figure 7

Occurrence.—Common everywhere in damp woods and in damp open fields. Mr. Shoemaker has it from the District, and there is a specimen in the Schönborn collection taken on July 1.

Season.—This species is single brooded. It appears just before the first of June and slowly increases in abundance, being most numerous in the last half of June and the first half of July, after which its numbers slowly decrease, although it may still be found in the first week in August. My earliest and latest dates are June 1 and August 3.

Remarks.—This species was originally described from Washington by W. H. Edwards, and his record was cited by Mr. Scudder.

Notes.—This is the only one of the smaller skippers which is common in the last half of June and early in July, when the great silver-spotted skipper (*Epargyreus tityrus*) is also at its maximum.

POLITES MANATAAQUA MANATAAQUA (Scudder)

Plate 49, Figures 3, 4

Occurrence.—Uncommon. Mr. Shoemaker has taken this butterfly in the District, and there is a female in the Schönborn collection. There is a male in the National Museum collection captured in

Washington by A. Koebele on August 18, 1883. I have a male taken at Cabin John on September 12, 1926, and two females, one taken at Cabin John on September 17, 1926, and the other captured at Silver Spring on September 14, 1928.

Remarks.—There are probably at least two broods of this butterfly in the District.

POLITES CERNES (Boisduval)

Plate 49, Figures 5, 6

Occurrence.—This is one of the commonest skippers in the District and is found everywhere in grassy regions.

There are two specimens in the Schönborn collection, a male and a female, the former taken on May 29. I have a long series taken on June 2, 3, and 17, August 10, and September 12.

Seasons.—This butterfly is double brooded in this region. The first brood appears toward the end of May, and the insect is common until after the middle of June, when its numbers decrease, and it almost entirely disappears in July. The second brood makes its appearance about the last of July, and the butterfly is abundant in the last half of August and the first half of September, flying, in diminishing numbers, until early in October.

Genus ATALOPEDES Scudder

ATALOPEDES CAMPESTRIS (Boisduval)

SACHEM

Plate 16, Figure 3; Plate 35, Figures 2 to 5

Atalopedes campestris CLARK, Animals of land and sea, 2d ed., p. 284, upper figure (gynandromorph), 1927.

Occurrence.—Abundant everywhere in open fields. Except for the least skipper (*Ancyloxypha numitor*) and the little *Polites coras*, this is the commonest of the smaller skippers in the District. It is frequent in spring, common in midsummer, and reaches its maximum abundance about the middle of September. It flies until after the middle of October.

Mr. Shoemaker has taken it along the Eastern Branch on September 23, 1927, and at Mount Vernon, Va., on September 22, 1927. There are two males and three females from the District in the Schönborn collection.

The National Museum collection contains 4 specimens, 2 taken in Washington by F. C. Pratt on October 26, 1894, 1 taken in Washington in 1915, and 1 taken in the District on July 24, 1892.

Habits.—Though usually keeping in the grass, or at least near the ground, and feeding on the flowers of clover and other low-growing plants, this species is frequently seen on the flowers of the buttonbush (*Cephalanthus occidentalis*) in company with the silver-spotted skipper (*Epargyreus tityrus*), and late in summer on thistle flowers in company with the same species and *Erynnis leonardus.* The females seem to be somewhat more numerous than the males.

The males have a curious way of hovering about the female, first on one side and then on the other 3 or 4 inches away, passing from one side to the other very rapidly in an arc behind her.

Broods.—Mr. Scudder says that the available information indicates that this species is three brooded, appearing in April, July, and September.

Remarks.—At Cabin John on July 25, 1926, I caught a specimen (pl. 16, fig. 3) with the wings of the right side male and those of the left side female. A figure of this curious individual was published in 1927. This is the only known instance of this condition among the skippers.

Genus CATIA Godman and Salvin

CATIA OTHO EGEREMET (Scudder)

Plate 21, Figures 6, 7

Occurrence.—Common throughout the District, occurring in open fields. Mr. Shoemaker has taken this butterfly in the District, there are two specimens from the District in the Schönborn collection, and I have specimens from the meadows at Cabin John, taken June 2 and 30. 1929, July 29, 1928, and from Silver Spring, taken August 14, 1927.

Remarks.—This species is probably double-brooded in the District, for while it is worn and faded, though still numerous, at the end of July, fresh specimens are on the wing again the middle of August. Mr. Scudder has noted that it is less vigorous and bustling than most skippers. It appears rather inert and stupid, and when startled it seldom flies for more than a short distance.

Genus ATRYTONE Scudder

ATRYTONE LOGAN LOGAN (Edwards)

Plate 19, Figures 4 to 9

Occurrence.—Not very common. I have specimens taken in the fields beyond Cabin John on August 8, 1926, and in meadows at Riverdale on July 23, 1928. It is to be looked for in damp places.

Remarks.—In this region this butterfly probably has only a single brood. As Mr. Sprague has noticed, it is unusually shy for a small skipper.

ATRYTONE VESTRIS (Boisduval)

Plate 21, Figures 4, 5

Occurrence.—Fairly common in damp open fields.

Mr. Shoemaker has specimens taken in the District on June 9, 1910, and I have specimens from Beltsville taken on June 29, 1929, and July 23, 1928, from Cabin John, caught on June 1, 1930, and August 27, 1926, and from the District without date.

Remarks.—This species is single brooded, but is found on the wing from the latter part of May until the first week in September.

ATRYTONE PONTIAC (Edwards)

Plate 54, Figures 1 to 6

Occurrence.—Confined to boggy meadows with sphagnum adjacent to woods; very local, but abundant where found. I secured a large series in the bog just east of the railway station at Beltsville, Md., where it occurs in equal abundance on both sides of the road, on July 4, 1929 and 1930, July 15, 1928, and July 29, 1929 and 1930, and others at Riverdale on July 23, 1928.

Season.—This skipper appears in the last week in June and flies until about the end of July. It is most abundant in the middle of July. There is only a single brood.

Remarks.—This skipper is much less alert and active than most of its relatives. It usually keeps in the grass and has a weak and rather slow flight with the skipping motion less evident than is usual in this group. It frequently hovers in the grass after the fashion of *Poanes massasoit*. As a rule, it does not fly very far, seeming to tire easily. It is unsuspicious and not easily frightened, so that it is readily captured. It is very fond of flowers, especially of those of the buttonbush (*Cephalanthus occidentalis*). It is also fond of sunning itself on grass blades with the fore wings erect and parallel and the hind wings extended horizontally. The females are very much less numerous than the males, and are also more sluggish.

When mated pairs are disturbed, the female flies off carrying the male.

The specimens taken on July 15 were all somewhat worn, but the females were very much less worn than the males. Those taken on July 23 were very much battered, and those taken on July 29 were mostly females. The females probably appear about a week later than the males and are still to be found after the males have disappeared.

Males from Newtonville, Mass. (pl. 54, figs. 1, 2), taken on July 17 show less wear than those from Beltsville taken on July 15 (pl. 54, figs. 3, 4). In the vicinity of Boston they first appear about July 10, and the earliest date can not here be very much in advance of this.

When compared with this series from eastern Massachusetts the local males are found to show slight average differences which, however, are trivial. They are slightly smaller and somewhat darker, with the yellow markings on the fore wings rather less extensive. Some of them are very dark, with the yellow on the hind wings reduced to a mere trace, consisting of two short dashes, and the yellow on the fore wings reduced to a band beyond the stigma which is about as broad as the stigma itself, a short, narrow dash just beyond the anterior end of the stigma, and one or two minute subapical spots.

Genus POANES Scudder

POANES MASSASOIT HUGHI A. H. Clark

SOUTHERN HOVERING SKIPPER

Plate 53, Figures 3, 4, 7, 8

Diagnosis.—Resembling *P. m. massasoit* but slightly larger and darker, the females with the yellow markings above reduced to small spots and partly, or sometimes completely, absent. Beneath with the costal and outer border of the fore wings and the ground color of the hind wings much darker and more reddish than in *P. m. massasoit*, and the yellow markings on the hind wings less extensive. Yellow markings on the hind wings beneath consisting of a broad yellow band, often more or less obscured except for the inner end and the outer third or fourth with rusty, as wide as the interspace, which basally extends for a short distance within the cell and outwardly ends at a distance from the outer border which is somewhat greater than the length of the fringe; above the outer third of this band is a small, yellow, oblong spot, not twice as broad as long, with sometimes a similar or smaller one above it; between the outer end of the band and the abdominal border of the wing is a series of two or three oblong spots, which are usually about twice as long as broad.

Types.—Male, U.S.N.M. No. 34439; female, No. 34440.

Comparisons.—Compared with a series of five males and one female (pl. 53, figs. 1, 2, 5, 6) from a bog in the woods at Weston, Mass., taken on July 9, 1923, the specimens from Beltsville average slightly larger, while the color is uniformly darker in both sexes, being blackish brown, the darkest males with violet reflections.

The males not infrequently show three small spots in a row extending directly inward from the costal margin of the fore wings about two-thirds of the distance from the base to the apex, and on the hind wings the last two discal spots of the female may be indicated by a few yellow scales.

The females have the yellow markings above greatly reduced. On the fore wings, while the three small dashes near the costal margin two-thirds of the distance from the base to the apex are similar to those in the northern form, the two spots in the lower median interspaces are only about half as large as they are in the northern female, and there are no other markings on the fore wings. On the hind wings only the last two of the row of four discal dashes are represented, these being only about half the size of those in the northern form, and the spot in the last subcostal interspace is absent or is indicated by a few yellow scales. Rarely the females are wholly without yellow markings above.

Beneath in both sexes the costal and outer border of the fore wings and the ground color of the hind wings is much darker and more reddish than in northern specimens, and the yellow markings are much less extensive. The interspace between the third median and the lower radial veins is occupied by a broad yellow band as wide as the interspace which basally extends for a short distance within the cell and outwardly ends at a distance from the outer border, which is somewhat greater than the length of the fringe. Beneath this are two spots occupying the whole width between the next two interspaces, which are about twice as long (parallel to the veins) as broad; their inner ends lie beneath about the middle of the yellow band, and their outer ends lie some distance within its outer end. Above the yellow band and opposite its middle is a yellow spot occupying the whole width of the next interspace, which is somewhat longer than broad. Above the inner end of this spot there may be another small spot. The conspicuous subcentral yellow band is usually somewhat, and occasionally largely, obscured with rusty scales, leaving clear yellow only the portion within the cell and the outer end for a distance about equal to the length of the spot next beneath. In the northern specimens the spots beneath the yellow band run inward to the origin of the veins between which they lie, and there is a third spot which is only indicated in the southern specimens.

The marked differences between the specimens from Beltsville and those from Weston, Mass., would appear to indicate that the two series represent two recognizable forms.

Though Mr. Scudder's figure represents a typical northern female on the lower surface, the fore wings above are less brown than in my northern female, while on the fore wings the 2 yellow spots beyond and below the 3 subapical spots and the spot within the cell are lacking, and on the hind wings the line in the last subcostal interspace and the first 2 of the 4 discal dashes are vestigial. Doctor Holland's figures show the typical brownish northern male together with the type of female found at Beltsville, though with the yellow spots darker and very slightly larger.

Mr. Scudder's description, except for the account of the markings on the upper side of the female, fits rather the southern than the northern form. Doctor Holland described the underside of a northern male and the underside of southern females, his descriptions therefore agreeing with his figures.

Mr. Scudder did not give the localities of the specimens which he described, but the size he gave for both sexes agrees with the size of individuals from Beltsville, individuals of both sexes from Weston having the fore wings only 13 mm. long. In other cases (as, for instance, in the case of *Argynnis idalia*) his measurements show that his material came from localities south of Boston, and this seems to have been true, in part at least, in regard to this species. Apparently he was not acquainted with this skipper in life.

Under the name *suffusa* Philip Laurent has described a form of this butterfly (pl. 53, figs. 11, 12) from the vicinity of Philadelphia. He says:

> The variation consists principally in the yellow markings of the under surface of the posterior wings being almost obliterated by a suffusion of dark brown, the light colored margin found in the normal form being entirely wanting. About 1 in every 10 specimens will be found to be *suffusa*. The variation is generally found among the males, but more sparingly where it occurs in the females. The insect is without the usual yellow spots on the upper surface of the wings.

A specimen of *suffusa* at hand from New Jersey (pl. 53, figs. 11, 12) shows that this form is quite different from *hughi*. The entire lower surface of the hind wings is suffused with, and the whole color pattern is obscured by, dark rusty brown. In *hughi* the suffusion of rusty brown restricts the extent of but does not obliterate the bright yellow markings.

A somewhat similar state of affairs is found in *Satyrodes eurydice*, occurring in the same bog, which is uniformly darker here than about Boston, although the very dark form known as *fumosus* does not occur.

Notes.—A male taken on July 26, 1931, has the yellow markings on the underside of the hind wings reduced to a row of four small spots less than twice as long as broad parallel to the outer margins of the wings, another slightly shorter spot in the interspace above the topmost of these spots with its outer end half its length farther from the edge of the wing than the inner end of the spot just below, and a very small yellow spot in the cell.

Another male taken at the same time has the yellow markings on the hind wings below completely covered by a deep rusty suffusion. This exactly corresponds to the form *suffusa* of *P. m. massasoit.*

Occurrence.—Confined to boggy meadows with sphagum adjacent to woods. It is very local, but wherever found it is abundant. I only know it from a single bog crossed by the road between the railroad station at Beltsville and the Department of Agriculture experiment farm. Here it is exceedingly numerous within two small areas scarcely 50 feet square, one on either side of the road; but beyond these limited areas it rapidly becomes scarce in every direction.

This bog, especially the wetter area where this butterfly is found, is subject to inundation in heavy rainfalls. From the abundant mud left high on the ferns and grass blades after a sudden rise in the water, it is quite evident that the early stages of this insect must be capable of withstanding total submergence of some hours' duration. In the locality where I have found it abundantly at Weston, Mass., the same conditions occur. (See Postscript, p. 256.)

Habits.—The hovering skipper has a very slow and cautious flight, which, as its wings are moved with great rapidity, gives it the appearance of hovering along as it progresses in a tortuous course, winding in and out among the grass blades 2 or 3 inches below their tips. During flight the body is held at an angle of about 45° with the ground. But in spite of its apparent sluggishness this species seems to spend more time upon the wing than do most skippers. When sunning itself on a grass blade the fore wings are held erect and parallel and the hind wings are spread out horizontally.

Except for the least skipper (*Ancyloxypha numitor*), this is the only one of the local skippers that flies on cloudy days, or late in the afternoon. But it prefers to fly on sunny days, in the shadows of the grass tops.

Slow and deliberate as is this butterfly under ordinary circumstances, it is capable of displaying a fair degree of energy if necessity demands it. It is very pugnacious and will at once attack any other skipper that comes near it, for this purpose rising up above the grass tops.

In the bogs with it lives *Atrytone pontiac*, and hostilities between the two are frequent. Several times I have captured two skippers engaged in combat from 6 inches to a foot or more above the grass tops and found a male of each of these species in the net. These combats, in which the two belligerents circle about each other without changing their position appreciably in relation to the ground, usually end with both dropping into the grass, *Poanes massasoit* almost directly, the other diagonally.

When frightened this skipper often makes an irregular dash of a few feet and drops into the grass, in the same manner as the least skipper (*Ancyloxypha numitor*) and *Atrytone pontiac.* On such occasions it will rise 2 or 3 inches above the grass tops.

This species seems to take but little interest in flowers. It is sometimes seen on the flowers of the buttonbush with the wings tightly closed above the back and the fore wings drawn as far as possible in between the hind wings. It is quite unsuspicious, but if frightened it flies diagonally downward with a weak skipping flight into the grass, where alone, apparently, it feels secure.

In spite of the abundance of the males, females are rather scarce, and I found only 3 among more than 50 males actually caught and many more observed.

Season.—The hovering skipper is single brooded, flying through July. In 1929 I made a very careful search for this butterfly week by week, and it certainly was not present up to and including June 29. But it was common on July 4, when many of the individuals were worn. It must appear, therefore, about July 1, or about a week after *Atrytone pontiac*, which flies with it. In 1928 it was exceedingly abundant on July 15, when most of the more than 50 caught were fresh. On July 23 the numbers were greatly reduced and all the individuals were very frayed. On July 30 none were found.

According to Mr. Scudder, this species appears in New England in the first half of June, a second brood appearing in the second week in July, " fresh specimens continuing to emerge throughout this month and remaining on the wing until after the middle, and probably nearly to the end, of August."

My experience with this insect in the vicinity of Boston, which is limited to a single bog surrounded by woods and subject to inundation in the spring, indicates that the time of the first appearance and the length of the season are the same as here, and also that the insect is single brooded. Mr. Laurent found it to have but a single brood in the vicinity of Philadelphia.

It is quite likely that the time of the first appearance of this butterfly varies considerably with the type of bog inhabited. If this were the case, a small series of specimens assembled from different bogs might very easily give the appearance of a 2-brooded form.

POANES VIATOR (Edwards)

BROAD-WINGED SKIPPER

Plate 20, Figures 3, 4

Mr. Shoemaker writes me that Mr. Schönborn told him he had taken this species on flowers in the United States Botanic Garden.

POANES HOBOMOK (Harris)

Plate 54, Figures 13 to 18

Occurrence.—Uncommon. In the Schönborn collection there are 2 males, 1 dated June 5, and 7 of the dark females (form *pocahontas*). Mr. Shoemaker has specimens taken in the District without date, and in Arlington County, Va., on May 26, 1900. I have two males and several dark females from Cabin John and Silver Spring, Md.

Season.—This species is single brooded. It first appears in the last week in May, is most frequently seen during July and August, and disappears before the middle of September. The earliest and latest dates available are May 26 and September 10.

Remarks.—In this butterfly the two sexes inhabit quite different regions and meet only on the borders of their respective areas. The males are found in damp glades in the woods and especially along the banks of streams, while the females are seen only in open fields often at a considerable distance from the woods. Such a separation of the sexes is characteristic of various butterflies in tropical America, but is unusual in this region.

In New England I have found both sexes of this insect in the same regions.

POANES ZABULON (Boisduval and Le Conte)

Plate 54, Figures 7 to 12

Occurrence.—Frequent, and sometimes rather common, the males in damp open glades in the woods near streams and along the grassy banks of streams flowing through woods, the females occurring in open fields more or less near damp woods. Mr. Shoemaker has a specimen from the District taken on May 22, 1900, and there are six specimens from the District in the Schönborn collection.

There are two specimens from Washington in the National Museum collection, a male and a female taken by A. Koebele on June 4, 1882.

Season.—This species is single brooded. It usually appears during the last week in May, sometimes as early as the second week, is most common during July and August, and disappears just before the last week in September. The earliest dates are May 11 and 22, and the latest September 19.

Though usually this butterfly is first seen at about the first of the last week in May, in 1930 it appeared in the second week in May and was common by the end of the month.

Notes.—This beautiful skipper is usually seen sunning itself on leaves from 3 to 5 feet from the ground, or on tall grass blades. It feeds by preference on tall yellow composite flowers. It is a very active insect, rather shy, and very pugnacious.

My experience with this species in the vicinity of the District has been that the males and females are seldom found together. The males keep rather strictly to the banks of streams flowing through the woods, or to damp glades, where the females are never seen, while the females wander rather widely over open fields. In New England, however, both males and females are found in the same areas.

Genus ATRYTONOPSIS Godman and Salvin

ATRYTONOPSIS HIANNA (Scudder)

Plate 14, Figures 4 to 6

I took a single female of this species at Cabin John, Md., on June 2, 1929. It should be not uncommon here, as it occurs as far south as Raleigh and Tryon, N. C.

Very different from the typical female recorded above is another taken at Cabin John on August 26, 1929, and kindly identified for me by Foster H. Benjamin. It is very dark in color. The hoary bloom on the underside is absent except for a narrow border on the fore wings confined to the upper half and twice as broad opposite the cell as elsewhere, which is tinged with dull violet. The hind wings below are deep brown obscurely washed with dull violet in the outer fourth and with a large indefinite patch of this color just within the middle of the wing. There are no white spots on the hind wings below. So far as I am aware there are no previous records for this species anywhere later than June.

Genus AMBLYSCIRTES Scudder

AMBLYSCIRTES VIALIS (Edwards)

ROADSIDE SKIPPER

Plate 52, Figures 17, 18

Occurrence.—This little butterfly is not very common. It is found in damp meadows and along the grassy sides of roads through moist ground where it flies in company with the least skipper (*Ancyloxypha numitor*). The Schönborn collection includes one from the District taken on April 30, Mr. Shoemaker has specimens from the District without date, and I have one taken by the side of a wooded road at Riverdale, Md., on July 23, 1928. I noticed it in the same place May 30, 1929.

Remarks.—The flight of this species is very swift for such a small butterfly, and so irregular as to be difficult to follow with the eye. It always keeps very near the ground and prefers to fly over and along roads or about bare and sterile patches of ground.

The resting position resembles that of the gray darter (*Pyrgus tessellatus*), the fore wings being slightly divergent and the hind wings more widely spread, though not quite to the horizontal. When it is feeding the wings are held erect and parallel.

Mr. Scudder noticed that the roadside skipper when at rest has the habit of moving its antennae in the same way as the least skipper (*Ancyloxypha numitor*). But this curious habit is more common among skippers than he supposed.

There are at least two broods of this butterfly in the District, and probably three. The first brood appears the last of April and the second about the third week in July. There should be a third brood, if only a partial one, in September.

Genus MEGISTIAS Godman and Salvin

MEGISTIAS FUSCA (Grote and Robinson)

Plate 3, Figure 8

Occurrence.—This obscure little butterfly is not uncommon in moist open fields. The Schönborn collection contains three specimens—one dated July, 1892, and one presented by Mr. Shoemaker. Mr. Shoemaker's collection includes specimens from Arlington County, Va. I have several specimens taken at Cabin John on June 2, 1929, one specimen taken at Silver Spring on June 17, 1928, and four taken at the same place on August 14, 1928. It is most numerous about the middle of September, when it is found equally in the meadows at Silver Spring and at Cabin John.

Remarks.—This butterfly, on account of its small size and sluggish habits, is very easily overlooked. It is seldom seen above the grass tops, though on occasion it will rise to feed on the lower flowers of the thistles.

Genus LEREMA Scudder

LEREMA ACCIUS (Abbot and Smith)

Plate 53, Figures 17, 18

Mr. Shoemaker has specimens of this butterfly taken within the District. I did not meet with it until September 18, 1929, when I found it rather common in the open field just northeast of the underpass beneath the canal west of Cabin John. About a dozen were seen in an area of less than half an acre, and a pair taken.

It was noticed that this butterfly keeps rather near the ground and that it does not fly up into a net placed over it as do other skippers, but instead conceals itself in the grass. It is possible, however, that this was due to the cool weather on that day.

Genus PRENES Scudder

PRENES OCOLA (Edwards)

Plate 8, Figure 8

The Schönborn collection contains four specimens from the District taken on August 13 and 16 (2) and on September 4; the year is not stated. The only specimen in my collection was taken at Silver Spring on September 7, 1931.

Genus CALPODES Hübner

CALPODES ETHLIUS (Cramer)

Plate 50, Figures 7, 8

The United States National Museum collection contains five specimens of this species from Washington, D. C. Four of these were collected by A. B. Duckett on August 9, 1911, and are labeled "feeding on *Canna*." The fifth was collected by F. H. Chittenden on September 16, 1912. There are no other records. It is probably a more or less frequent visitor to the District, being brought in on *Canna*, but not properly a member of the District fauna.

NOTE

In addition to the species of Hesperiinae considered in the preceding pages, the following may occur in the District:

Polites vibex brettus (see p. 254).
Polites mystic (see p. 254).
Erynnis attalus (see p. 254).
Erynnis metea (see p. 254).
Atrytone bimacula (see p. 254).
Atrytone dion (see p. 255).
Amblyscirtes samoset (see p. 255).
Amblyscirtes textor (see p. 255).
Poanes aaroni aaroni (see p. 255).
Prenes panoquin (see p. 255).
Atrytonopsis loammi (see p. 256).

SEASONAL OCCURRENCE OF LOCAL BUTTERFLIES

In Table 2 the occurrence of the local butterflies throughout the season is shown. Each month is divided into halves. A minus sign (−) indicates that the species is to be found, but that the individuals are scarce or are in poor condition. A plus sign (+) indicates that the species is (or should be) common and all, or at least a large proportion, of the individuals are in good condition.

TABLE 2.—*Seasonal occurrence of butterflies in the District of Columbia*

Species	March		April		May		June		July		August		September		October	
Neonympha eurytus	----	----	----	----	----	−	+	+	+	+	−	−	−	−	----	----
Satyrodes eurydice	----	----	----	----	----	----	−	+	+	+	−	----	----	−	----	----
Cercyonis alope	----	----	----	----	----	----	----	----	−	+	+	−	−	----	----	----
Chlorippe celtis	----	----	----	----	----	----	+	----	----	----	----	+	+	+	----	----
Chlorippe clyton	----	----	----	----	----	----	----	----	----	----	----	+	+	----	----	----
Basilarchia arthemis	----	----	----	----	----	+	+	+	−	+	+	−	+	+	−	----
Basilarchia archippus	----	----	----	----	----	−	+	+	+	−	+	+	+	+	−	----
Junonia lavinia	−	−	−	−	−	−	−	+	+	−	+	+	+	+	+	−
Pyrameis atalanta	----	----	----	----	----	−	+	+	+	+	−	+	+	+	+	−
Pyrameis virginiensis	----	----	----	----	−	−	+	+	+	+	+	+	−	+	+	−
Pyrameis cardui	----	----	----	----	----	−	−	−	+	+	+	−	+	+	+	+
Vanessa antiopa	−	−	−	−	−	−	----	+	+	+	+	−	+	+	+	+
Polygonia interregationis	----	----	----	−	−	−	−	+	+	+	+	+	−	+	+	+
Polygonia comma	----	−	−	−	−	----	----	+	+	+	−	−	+	+	+	+
Phyciodes tharos	----	----	----	−	+	+	−	+	+	+	−	+	+	+	+	+
Phyciodes batesii	----	----	----	----	----	−	−	−	----	----	----	----	----	----	----	----
Euphydryas phaëton	----	----	----	----	----	----	+	+	+	----	----	----	----	----	----	----
Brenthis myrina	----	----	----	----	----	----	----	−	+	+	−	−	----	----	----	----
Argynnis idalia	----	----	----	----	----	----	----	−	+	+	+	+	−	−	−	----
Argynnis cybele	----	----	----	----	----	----	−	+	+	+	+	+	−	−	−	−
Argynnis aphrodite	----	----	----	----	----	----	----	----	−	−	−	----	----	----	----	----
Euptoieta claudia	----	----	----	----	----	----	−	+	+	−	+	+	−	+	−	----
Danaus plexippus	----	----	----	−	−	----	−	+	+	+	+	+	+	+	+	+
Libythea bachmanii	----	----	----	----	----	----	----	----	----	----	−	----	----	----	----	----
Chrysophanus phlaeas	----	----	----	−	+	+	----	+	+	+	+	+	+	+	+	−
Feniseca tarquinius	----	----	----	----	----	----	+	+	+	+	+	+	+	+	+	----
Everes comyntas	----	----	----	+	+	−	−	+	+	+	+	+	+	−	−	----
Lycaenopsis argiolus	----	−	+	+	+	+	+	−	−	+	+	−	+	−	----	----
Strymon m-album	----	----	----	−	----	----	----	−	−	----	----	−	−	----	----	----
Strymon melinus	----	----	----	−	−	−	−	−	−	+	+	+	+	+	----	----
Strymon ontario	----	----	----	----	----	----	----	−	----	----	----	----	----	----	----	----
Strymon titus	----	----	----	----	----	----	----	−	−	−	−	----	----	----	----	----
Strymon calanus	----	----	----	----	----	----	----	−	−	−	----	----	----	----	----	----
Mitoura gryneus	----	----	----	−	−	----	----	----	−	−	----	----	----	----	----	----
Incisalia augustinus	----	+	+	+	−	----	----	----	----	----	----	----	----	----	----	----
Incisalia irus	----	----	+	+	+	----	----	----	----	----	----	----	----	----	----	----
Incisalia henrici	----	----	+	+	+	----	----	----	----	----	----	----	----	----	----	----
Incisalia niphon	----	----	----	−	+	+	+	−	----	----	----	----	----	----	----	----
Eurema nicippe	----	----	----	----	----	----	----	+	+	−	----	----	+	+	−	----
Eurema lisa	----	----	----	----	−	−	−	−	+	+	+	+	+	+	−	−
Colias eurytheme	----	----	----	+	+	−	−	+	+	+	+	+	+	+	+	+
Colias philodice	----	----	−	+	+	−	−	+	+	+	+	+	+	+	+	+
Phoebis eubule	----	----	----	----	----	----	----	----	----	----	----	----	−	−	----	----
Anthocharis genutia	----	+	+	+	+	----	----	----	----	----	----	----	----	----	----	----
Pieris protodice	----	−	−	−	−	−	−	−	−	−	−	−	−	−	−	----
Pieris rapae	----	−	+	+	+	−	+	+	+	+	+	+	+	+	−	−
Papilio philenor	----	----	----	−	−	−	+	+	+	−	−	+	+	+	−	−
Papilio cresphontes	----	----	----	----	----	−	−	−	----	−	−	−	−	−	----	----
Papilio glaucus	----	----	−	−	−	−	−	+	+	+	+	−	−	−	−	----
Papilio troilus	----	----	----	−	−	+	+	−	−	−	+	+	+	−	−	----
Papilio polyxenes	----	----	----	----	----	−	−	−	−	−	+	+	+	−	−	----
Papilio marcellus	----	−	+	+	+	−	+	+	+	+	+	+	+	+	−	----
Epargyreus tityrus	----	----	----	−	−	+	+	+	+	−	−	−	−	−	−	----
Achalarus lyciades	----	----	----	----	−	+	+	+	+	−	−	−	----	----	----	----
Cecropterus cellus	----	----	----	----	----	----	----	−	----	----	----	----	----	----	----	----
Thorybes pylades	----	----	----	----	----	−	+	−	−	−	−	−	−	−	----	----
Thorybes daunus	----	----	----	----	----	−	−	+	−	−	−	−	----	----	----	----
Pyrgus centaureae	----	----	----	−	----	----	----	----	----	----	----	----	----	----	----	----
Pyrgus tessellatus	----	----	----	----	----	----	----	−	−	−	−	+	+	−	−	----
Pholisora catullus	----	----	----	−	−	−	−	−	−	−	+	+	+	−	----	----
Thanaos icelus	----	----	----	−	−	+	+	----	----	----	----	----	----	----	----	----
Thanaos brizo	----	----	----	−	−	−	−	----	----	----	----	----	----	----	----	----
Thanaos persius	----	----	−	−	−	−	−	----	−	−	−	−	----	----	----	----
Thanaos martialis	----	----	----	−	+	+	−	−	----	−	−	−	----	----	----	----
Thanaos juvenalis	----	−	−	+	+	−	−	----	----	−	−	−	−	−	−	−
Thanaos horatius	----	----	−	+	+	−	−	----	----	−	−	−	−	----	----	----
Ancyloxypha numitor	----	----	----	----	−	+	+	−	----	+	+	−	+	+	−	----
Erynnis leonardus	----	----	----	----	----	----	----	----	----	----	----	----	+	+	----	----
Hylephila phylaeus	----	----	----	----	----	----	----	----	----	----	−	+	+	−	−	----
Polites coras	----	----	----	----	−	+	+	----	----	----	−	+	+	−	−	----
Polites verna	----	----	----	----	----	−	−	+	+	−	−	----	----	----	----	----
Polites manataaqua	----	----	----	----	----	----	----	----	----	----	----	----	−	−	----	----
Polites cernes	----	----	----	----	----	−	+	+	−	−	−	+	+	−	−	----
Atalopedes campestris	----	----	----	−	−	----	----	----	−	−	----	+	+	+	−	−
Catia otho	----	----	----	----	----	----	−	−	----	−	−	−	----	----	----	----
Atrytone logan	----	----	----	----	----	----	----	----	----	−	−	----	----	----	----	----
Atrytone vestris	----	----	----	----	----	−	−	−	+	+	+	+	−	----	----	----
Atrytone pontiac	----	----	----	----	----	----	----	−	+	−	----	----	----	----	----	----
Poanes massasoit	----	----	----	----	----	----	----	----	+	+	----	----	----	----	----	----
Poanes hobomok	----	----	----	----	----	−	−	−	−	−	−	−	−	----	----	----

TABLE 2.—*Seasonal occurrence of butterflies in the District of Columbia*—Contd.

Species	March		April		May		June		July		August		September		October	
Poanes zabulon	----	----	----	----	−	−	−	−	+	+	+	+	−	−	----	----
Atrytonopsis hianna	----	----	----	----	----	----	−	----	----	----	----	−	----	----	----	----
Amblyscirtes vialis	----	----	----	−	----	−	----	----	----	−	----	----	----	----	----	----
Megistias fusca	----	----	----	----	----	−	−	−	−	−	−	−	+	−	----	----
Lerema accius	----	----	----	----	----	----	----	----	----	----	----	----	----	−	----	----
Prenes ocola	----	----	----	----	----	----	----	----	----	----	−	−	−	----	----	----

ODORS OF DISTRICT BUTTERFLIES

The odors exhaled by the scent scales of the males of local butterflies furnish an interesting field for investigation. In only a few cases have these been determined, and in no case have they been described in such a way as to convey any really definite meaning.

Most of the observations given below were made by myself, Austin B. J. Clark, and Hugh U. Clark on butterflies caught in the District, but the notes on *Argynnis aphrodite*, which is very rare here, were taken in Massachusetts.

S. H. Scudder first described the odor of the males of *Argynnis idalia*, *Lycaenopsis argiolus*, and *Pieris rapae*, and W. H. Edwards that of the female of *Papilio philenor*. The odor of the male of *Phoebis eubule* was first described by Fritz Müller from Brazilian examples, and later by Miss Mary Murtfeldt from specimens taken in Missouri, and George B. Longstaff from individuals caught in Colombia. Dr. F. A. Dixey redescribed the odor of *Pieris rapae* from examples caught in England, and the odor of *Papilio machaon* was described to me orally by Dr. Peter Sushkin, of Leningrad, Russia, his observations having been made in Germany.

Family NYMPHALIDAE

Subfamily SATYRINAE

None of the three species occurring in the District is known to possess an odor. The males of *Satyrodes eurydice* are entirely without scent scales (androconia), but these are abundant in the males of *Neonympha eurytus* and of *Cercyonis alope*.

Subfamily NYMPHALINAE

Basilarchia archippus.—The males have a slight sugary odor, the females a pronounced and disagreeable odor comparable to that of the females of *Danaus plexippus*.

Junonia lavinia.—The males of both the wet and the dry forms have a rather strong sugary odor, which sometimes quickly disappears.

Argynnis idalia.—The males have a strong, sweet, and spicy odor, which in general resembles that of the following species, but is sweeter and more flowery. It is very easily detected by smelling the upper surface of the fore wings, especially of more or less worn specimens. Pinching the abdomen of the female causes the extrusion dorsally from between the last two segments of a short and thick grayish forked organ somewhat resembling the osmeteria of the caterpillars of the swallowtails, which are protruded from the first thoracic segment. This has a powerful nauseating smell, which is much like that given off from the osmeteria.

Argynnis cybele.—The males have a strong spicy odor resembling that of sandalwood. The scent organ of the females is somewhat stouter than that of the females of *A. idalia* and is orange in color. Its odor is particularly strong and nauseating.

Argynnis aphrodite.—The odor of both the males and the females exactly resembles that of the corresponding sex of the preceding species.

Brenthis myrina.—The female possesses a scent organ resembling that in the females of the preceding species.

Euptoieta claudia.—The males have a rather strong spicy odor resembling that of the males of *Argynnis cybele.*

Subfamily DANAINAE

Danaus plexippus.—The scales within the little pouch on the hind wings of the males emit an odor resembling the faint sweet fragrance of red-clover blossoms, or of the flowers of the common milkweed. With this is a faint cockroachlike odor, which is found alone, and much stronger, in the females.

Family LYCAENIDAE

Subfamily LYCAENINAE

Lycaenopsis argiolus.—The males have, according to Mr. Scudder, an exceedingly delicate odor, which is comparable to that of newly stirred earth in spring, or of crushed violet stems.

Family PAPILIONIDAE

Subfamily PIERINAE

Eurema lisa.—The males have a pronounced fragrance, which is somewhat similar to that of the males of the yellow clover (*Colias philodice*), but sweeter and more flowery. In spite of the small size of this butterfly the odor is very easy to detect.

Colias eurytheme.—The males of the deep orange form have a rather strong and very sweet odor somewhat suggesting heliotrope. This odor is constant and very uniform.

Colias philodice.—The males have a rather strong odor, which is constant and very uniform, resembling that of dried "sweet grass," or of sweet hay.

Phoebis eubule.—The odor of the males, which is very pronounced, has been compared to that of violets, musk, *Stephanotis*, and *Freesia*.

Pieris rapae.—The odor of the males is faint and difficult to detect. It has been compared to that of mignonette and of sweetbrier.

Subfamily PAPILIONINAE

Papilio philenor.—The males have a sweet flowery odor somewhat similar to that of the males of the parsnip swallowtail (*Papilio polyxenes*), but not so strong. The females have a strong and disagreeable scent, pungent and penetrating, with a suggestion of acetic acid.

Papilio glaucus.—The males have a sweet flowery odor, varying from faint to fairly strong, which resembles that of the males of the spicebush swallowtail (*Papilio troilus*), though it is never so pronounced. The females have a strong and disagreeable odor, pungent or acid in character, which in some is very strong.

Papilio troilus.—The males of this species have the strongest odor of all the local swallowtails. It exactly resembles that of certain brands of honey biscuits.

Papilio polyxenes.—The males have a rather strong sweet odor like that of carrot flowers, quite the same, apparently, as that of the very closely related European swallowtail (*Papilio machaon*).

Papilio marcellus.—The males have a spicy odor, intermediate between that of the males of the other swallowtails and of the fritillaries (*Argynnis cybele* and *A. aphrodite*).

Family HESPERIIDAE

No observations have been made on the odors of either sex of any of the local skippers.

EMANATIONS FROM BUTTERFLIES' WINGS

Plates 59 to 64

It has long been known that when placed in contact with a photographic plate in complete darkness the wings of butterflies affect the plate in such a way that when the latter is developed a perfect image of the wings is formed, the intensity of the image on the plate being in general proportionate to the depth of the color on the wings. In a print made from a negative prepared in this way the darker the color on the butterfly the lighter will it appear in the print.

A series of experiments was undertaken with the object of adding to our knowledge regarding this curious phenomenon. The following 43 species were studied, all of which are native species except for two swallowtails (*Papilio paris* and *P. polyctor*) from Siam and a danaid (*Ituna lamirus*) from Colombia:

Neonympha eurytus (pl. 59, fig. 14).
Basilarchia astyanax.
Basilarchia archippus.
Junonia lavinia (pl. 63, figs. 4, 5).
Pyrameis virginiensis (pl. 62, figs. 10, 11).
Pyrameis cardui (pl. 64, fig. 3).
Vanessa antiopa.
Polygonia interrogationis (pl. 59, figs. 15, 16).
Phyciodes tharos (pl. 59, figs. 5, 6; pl. 62, fig. 8).
Euphydryas phaëton (pl. 59, fig. 13).
Argynnis idalia (pl. 60, figs. 3, 4; pl. 61, figs. 3, 4).
Argynnis cybele (pl. 60. figs. 1, 2; pl. 61, figs. 1, 2; pl. 62, figs. 1, 2).
Danaus plexippus (pl. 63, figs. 2, 3; pl. 64, figs. 1, 2).
Ituna lamirus.
Chrysophanus phlaeus (pl. 59, figs. 17, 18).
Everes comyntas (pl. 62, fig. 9).
Lycaenopsis pseudargiolus.
Mitoura gryneus.
Eurema lisa.
Colias eurytheme (pl. 59, figs. 11, 12).
Colias philodice (pl. 59, fig. 19).
Anthocharis genutia.
Pieris rapae (pl. 59, figs. 9, 10).
Papilio philenor (pl. 62, figs. 3, 5, 6; pl. 64, fig. 5).
Papilio polyxenes.
Papilio glaucus (pl. 63, fig. 1).
Papilio cresphontes.
Papilio troïlus (pl. 62, fig. 4).
Papilio paris.
Papilio polyctor (pl. 64, fig. 4).
Papilio marcellus (pl. 62, fig. 7).
Epargyreus tityrus.
Achalarus lyciades (pl. 59, figs. 7, 8).
Thanaos juvenalis.
Thanaos martialis.
Thorybes daunus.
Thorybes pylades.
Pyrgus tessellatus (pl. 63, figs. 6, 7).
Polites verna.
Erynnis leonardus (pl. 63, figs. 9–11).
Atrytone pontiac (pl. 59, figs. 3, 4).
Poanes massasoit (pl. 59, figs. 1, 2).
Atalopedes campestris (pl. 63, fig. 8).

The preparation of these pictures is a very simple matter. The wings, cut from the butterflies, are attached to pieces of paper, black or white, with drops of shellac. A fresh box of plates is opened in the dark room and the plates are removed. An old plate, or a piece of glass of proper size, is placed in the bottom of the box to form a firm and smooth backing for the paper with the wings, which is laid upon it. Then a fresh plate is placed, emulsion side down, upon the wings, another piece of paper with wings is placed upon the upper (glass) surface of this plate, a second fresh plate is placed, emulsion side down, upon these wings, and so on until all the plates have been replaced in the box, which is then closed and sealed and left in the dark room.

The brightness of the image produced on the plate is proportionate to (1) the length of exposure, (2) the degree of pressure against the plate, and (3) inversely to the age of the specimen.

Though very dark butterflies freshly caught will give fair results after an exposure of from 24 to 30 hours on an ordinary plate—

some, indeed, giving strong images in as little as 12 hours—really satisfactory results can be obtained only by exposure for at least a week.

When the pressure of the wing against the plate is uniform, all the details of the color pattern are faithfully brought out, but if the pressure is greater at one point than it is at another, the area of greatest pressure will appear most brilliant. This is particularly observable in the case of the thick veins near the bases of the wings.

While freshly caught or raised butterflies exposed immediately after death gave uniformly good results, butterflies of the same species which had been dead for two years gave results which were less satisfactory, the images being less bright with the same length of exposure. Examples of *Papilio paris* and of *P. polyctor* that had been dead for 10 years (pl. 64, fig. 4), gave images that were fainter than those from similarly dark native swallowtails that had been dead for two years. Specimens of *Argynnis cybele* and of *Basilarchia arthemis astyanax* that had been dead for 30 years gave only very faint images after an exposure of a week. In these two last the form of the wing was barely discernible, and the heavier veins, together with the lines of androconia on the males of *Argynnis cybele*, were the only portions that could be clearly made out. A specimen of *Papilio cresphontes* which had been dead for 40 years after 30 days' exposure gave a very faint, but distinct and readily recognizable image, while an example of *Ituna lamirus* which had been dead for 50 years, after 30 days' exposure gave a very faint and scarcely recognizable picture. The pigmentation in this last species, however, is very light.

The best and most striking results are obtained from very dark butterflies, particularly the sooty skippers (*Thanaos*), and from butterflies with a large amount of black or very dark brown, such as the zebra swallowtail (*Papilio marcellus*, pl. 62, fig. 7.), the Camberwell beauty (*Vanessa antiopa*), and the pearl crescent (*Phyciodes tharos*, pl. 59, fig. 5). Female butterflies, if colored like the males, usually give a brighter image because of the heavier pigmentation.

The image from the upper surface of the wings is almost invariably brighter than from the lower. Usually this difference is slight, but sometimes it is very marked (pl. 59, figs. 5, 6, 9, 10, 15, 16). Rarely the image from the lower surface of the wings is brighter than that from the upper surface. I have found this to be the case in *Junonia lavinia* (pl. 63, figs. 4, 5.)

The small rapidly flying butterflies, particularly the skippers (pl. 59, figs. 1–4, 7, 8; pl. 63, figs. 6, 7, 8–11), give the brightest images, the large butterflies always giving images which are less bright with the same length of exposure.

If we disregard the usually strong effect of the thick costal vein as being possibly due to pressure against the plate, the strongest effect is produced in practically all cases by the apical portions of the fore wings and more or less of their outer border (pl. 64, fig. 1), while the inner (lower) margin of the fore wings gives the least effect. In some cases the wings are brightly outlined when there seems to be no reason for this in the color pattern (pl. 63, fig. 4; pl. 64, fig. 4).

Nearly all the species tried gave equally good and strictly comparable results, but some interesting discrepancies were noted.

In the males of the skippers of the subfamily Hesperiinae the patches of androconia come out with great brilliance (pl. 63, fig. 8), probably on account of the greater thickness of the wing here and the resultant pressure.

The upper surface of *Pieris rapae* (pl. 59, fig. 9) affects the plate as if it were a very dark instead of a white insect, the image being much brighter than that of the dingy underside (pl. 59, fig. 10).

The upper surface of the males of both of the common blues (*Lycaenopsis argiolus pseudargiolus* and *Everes comyntas*, pl. 62, fig. 9) gave surprisingly bright and distinct images.

In fresh examples of *Papilio philenor* the whitish spots on both surfaces acted as if they were black (pl. 62, fig. 6), but in old and worn examples the whitish spots acted normally. In *Papilio paris* and in *P. polyctor* (pl. 64, fig. 4) the iridescent green areas affected the plates much more intensely than the dark-brown ground color of the wings. Reversal of color values in swallowtails, and also in the closely related parnassians (*Parnassius*), has previously been noted.

In order to ascertain the nature of the emanations affecting the photographic plates, (1) exposures were made with the glass side of the plate in contact with the wings; (2) portions of the wings were covered with exceedingly thin cover glasses; (3) portions of the wings were covered with strips of cellophane, which has the property of being far more transparent to light of very short wave lengths than glass; and (4) portions of the wings were covered with bits of quartz ground down to a thickness of 0.2 mm., which were very kindly loaned by Dr. W. W. Coblentz, of the Bureau of Standards.

The exposures made with the glass side of the plates in contact with the wings were uniformly negative.

The cover glasses completely obliterated the portions of the wings covered by them.

The strips of cellophane had a surprisingly slight effect upon the image made by the portions of the wings covered by them. Their position was indicated simply by a slightly lighter band across the wing.

The strips of quartz obliterated the portions of the wings beneath them as completely as did the glass.

Experiments with various kinds of films gave divergent, though always unsatisfactory, results. The color values were always the same with films as with the plates.

If the phenomenon were due to light of a very short wave length—that is, if it were a sort of invisible phosphorescence—this light should pass through the quartz as readily as through the cellophane. But the quartz completely obliterates those portions of the wings over which it lies even in exposures of 30 days' duration.

That the phenomenon is due to the effect upon the photographic plate of some gas and not to light was from the first maintained by Dr. Raymond S. Davis, of the Bureau of Standards, and by Dr. A. J. Olmsted, of the National Museum, and their assumption appears to have been shown to be correct by these experiments. For while gas as well as light will pass through cellophane, glass and quartz are impervious to gases.

It was suggested by Dr. Burt H. Carroll, of the Bureau of Standards, that possibly the effect was due to sulphur. As a result of this suggestion exposures were made on burnished metallic silver.

Although the butterflies used for these exposures had been dead for about two months, faint images were produced on the silver by an exposure of 24 hours. The images, though recognizable, were so faint as to appear as a slight colorless frosting, and while presumably due to some gas containing sulphur, there is no conclusive proof of this.

So far as we are able to judge from the facts as present available, the images produced on photographic plates by direct contact with butterflies' wings are due to the slow decomposition of the pigments in the wings and the resulting emanation of some gas or gases containing sulphur. But fully conclusive and convincing proof of the cause of the phenomenon is not yet at hand.

APPENDIX: BUTTERFLIES OF PROBABLE OR POSSIBLE OCCURRENCE IN THE DISTRICT

In addition to the butterflies actually recorded from the District and discussed in the preceding pages, there are a number of others which are to be looked for here as casuals, as occasional temporary residents, or as very local residents which heretofore have escaped detection. Among these, those listed in the following pages are worthy of special mention. Practically all of them occur regularly, or at least frequently, in localities which can be reached in half a day or less by automobile from Washington.

The inclusion of such northern species as *Vanessa milberti*, *Polygonia faunus*, *Argynnis atlantis*, and *Strymon acadica* perhaps calls for a word of explanation. As was noted in the introduction, the District area is strongly northern in its affinities, no less than 14 species here reaching their extreme southern limit at sea level. The heavily wooded cold boggy areas, such as the Paint Branch Valley, near the District are as yet very imperfectly known. In some localities in these areas conditions are such as to make one suspect that these insects might occur, and they are included herein in the hope that in the future a careful search will be made for them.

With the increasing extension of the suburbs of the city of Washington and the progressive clearing of the surrounding country, an increase in the number of southern and western species and a decrease in the number of the northern are to be expected. It is to be hoped, therefore, that the valleys of the cool woodland streams about the District will be thoroughly searched before it is too late.

I am greatly indebted to Dr. William T. M. Forbes for his kindness in going over for me the list of species included in the following pages.

Family NYMPHALIDAE

Subfamily SATYRINAE

NEONYMPHA GEMMA Hübner

Plate 2, Figures 4, 5

This species, easily recognizable by the silver markings along the margin of the underside of the hind wings, may occur in the District.

NEONYMPHA PHOCION (Fabricius)

Plate 2, Figures 2, 3

This species is more likely to be found in the District than the preceding. It is easily recognized by the large oval spots on the undersurface of the hind wings. Very common in northern Florida and ranging northward to New Jersey, it is especially characteristic of open pine woods and adjacent grass lands. In its habits it resembles the common wood nymph, but like the preceding it is less active and has a lower and weaker flight.

NEONYMPHA SOSYBIUS (Fabricius)

Plate 56, Figures 7, 8

This common southern species is to be looked for in the vicinity of the District. It resembles *Neonympha eurytus* but is smaller and darker, the wings above are entirely unmarked, and the fore wings below have only a single small eye spot near the apex. In its habits, as I have seen it in Florida, it is much like *N. eurytus*, but less active.

CERCYONIS ALOPE PEGALA (Fabricius)

Plate 2, Figures 6 to 8

This southern species ranges northward to New Jersey. In its habits it is quite the same as *C. a. alope*, but in correlation with its larger size it is more active and energetic and consequently more difficult to catch.

ENODIA PORTLANDIA (Fabricius)

Plate 1, Figures 7, 8

Although occurring over an enormous area in eastern North America, this species is almost everywhere very local. It certainly should be found somewhere in the more or less immediate vicinity of the District. It is to be sought for in dark ravines and in dark hillside thickets.

In coloration this species closely resembles the grass nymph (*Satyrodes eurydice*), but the fore wings are more pointed with the outer margin straight or slightly concave instead of evenly rounded, while the hind wings are narrower and have a scalloped instead of a broadly and evenly rounded outer border.

Subfamily NYMPHALINAE

VANESSA MILBERTI (Godart)

Plate 12, Figures 3, 4

This species is quite likely occasionally to occur in the District as a casual visitor. It is a northern form which ranges southward into the mountains of West Virginia. From time to time it appears in great abundance and becomes more or less migratory.

The broad orange bands margined interiorly with lighter in the outer third of the wings and the two orange spots near the costal border of the fore wings make this species a very easy one to recognize.

VANESSA J-ALBUM (Boisduval and Le Conte)

Plate 10, Figures 1, 2

In the Schönborn collection there is a specimen of this species caught by Otto Lugger in the Druid Hill Park, near Baltimore, Md., on January 2, 1882. This northern species ranges southward into the mountain districts of Pennsylvania. When common it occasionally migrates in considerable numbers far beyond its usual range. It is quite likely to be found as an erratic casual in the District.

This butterfly is to be looked for on warm days in winter and in very early spring. It is active at a lower temperature than any of the local butterflies.

This species lives the longest in the adult stage of all the butterflies in North America, some individuals, at least, living for 12 months or perhaps even longer. It passes the winter hibernating as an adult, and in summer it becomes torpid during unusually warm weather.

There is no other American butterfly with which this can be confused. It is dull orange marked with dark brown.

POLYGONIA FAUNUS (Edwards)

GREEN COMMA

Plate 11, Figures 5, 6

This northern butterfly may possibly occur as a casual in the District, as it is found southward in the mountains to Georgia and South Carolina. It is an exceedingly active butterfly, more alert and quicker in its motions than the comma.

It resembles the comma (*Polygonia comma*) in having the silvery comma on the underside of the hind wings expanded at the ends, but the wings are more deeply incised, the middle of the outer border of the fore wings being conspicuously crenulated, and the outer third of the lower surface of the wings is variegated with green.

DIONE VANILLAE INCARNATA (Riley)

PASSION-FLOWER FRITILLARY

Plate 12, Figures 1, 2

The passion-flower fritillary is very common in Florida and locally northward along the coastal plain to Norfolk, Va. It is infrequent or of casual occurrence north of this point.

In its flight it greatly resembles *Argynnis cybele* or *A. aphrodite*, but it is not so active and the flight is lower, usually 2 or 3 feet above the ground. In its flight as in the shape of its wings it is intermediate between our local fritillaries and the heliconians of the American tropics.

ARGYNNIS ATLANTIS (Edwards)

Plate 14, Figures 2, 3

This northern species, which ranges south into West Virginia, is especially characteristic of cold bogs surrounded by woods and the marshy banks of mountain streams flowing through woods. In contrast to the related species recorded from the District, this form frequently occurs in small isolated colonies, the presence of which may be wholly unsuspected. It may be at once distinguished from *A. cybele* and *A. aphrodite* by its different flight, which resembles that of *A. nevadensis*.

In color it closely resembles *A. aphrodite* but is easily distinguished by the dark margins on the wings above and by the difference in the shape of the silver spots on the hind wings below.

BRENTHIS BELLONA (Fabricius)

BELLONA

Plate 4, Figures 6 to 8

This butterfly has almost the same range as *B. myrina*, and is commonly found with it. It is therefore likely to occur somewhere in the vicinity of Washington. It is abundant in Pennsylvania and western Maryland and southward in the mountains of western and southwestern Virginia and West Virginia, occurring also in northwestern North Carolina and in Tennessee. On the coast it occurs southward to southern New Jersey.

In its habits it closely resembles *B. myrina*, but it is rather less active.

Though *Brenthis bellona* and *B. myrina* often, perhaps even usually, occur together, they prefer a slightly different type of habitat. *Brenthis myrina* is especially characteristic of open grassy bogs surrounded by rough scrubby pasture land, while *B. bellona* is characteristic of boggy and grassy banks of small streams in wooded valleys in hilly or mountainous country.

The locality at Beltsville, Md., where *B. myrina* is found, is quite a typical locality for it, and at the same time a locality where one would scarcely expect to find *B. bellona*.

In the Greenbrier Valley in West Virginia I have found *B. bellona* common in wet grassy areas where the mountain streams flowed through a small bit of level land; but *B. myrina* here was absent. In a bog at Essex, Mass., fed by a small stream flowing through a wet grassy area bordered by woods and encumbered by brush, *B. myrina* is very common, but *B. bellona* is wholly confined to the wet brushy hillside above the bog.

Brenthis bellona is to be looked for especially in boggy patches bordering Paint Branch and similar spots in the adjacent portions of Maryland.

It is easily distinguished from *B. myrina* by having the underside of the hind wings brownish yellow mottled with purple, and entirely without silver spots.

PHYCIODES NYCTEIS (Doubleday and Hewitson)

Plate 15, Figures 3, 4

This common species should be found, at least casually, in the vicinity of the District. It is larger than *P. tharos* and is most easily distinguished by having the third submarginal spot from the anal angle on the hind wings above with a conspicuous light center—that is, replaced by a thin black ring.

PHYCIODES CARLOTA (Edwards)

Plate 18, Figures 3, 4

It is possible that this wide-ranging form occurs casually in the District area.

This species is readily recognized by the deeply scalloped outer border of the dark ground color of the hind wings below, and by the narrow tortuous line of pearly spots crossing the middle of the underside of the hind wings.

Family RIODINIDAE

CHARIS BOREALIS (Grote and Robinson)

Northern Metal Mark

Plate 28, Figure 9

This curious little butterfly has a fluttering, though rather fast, flight, which resembles that of a geometrid moth. It alights on the undersides of leaves and twigs with the wings expanded and touching the supporting surface, also like a moth. It is unlikely to be taken in the usual course of butterfly collecting, but may turn up in collections of the smaller moths. It is occasionally taken about lights to which, mothlike, it is attracted at night.

In color this species is dark dull violet-brown above speckled with black, and beneath brownish yellow speckled with darker; there are two rows of small metallic spots near the borders of the wings on both surfaces, but larger below.

CHARIS VIRGINIENSIS (Guenée)

SOUTHERN METAL MARK

Plate 28, Figure 8

This extremely small butterfly, which spreads less than three-quarters of an inch, is very common in the Southeastern States and ranges northward into Virginia. It may possibly be found in the District area.

It is lighter in color than the preceding species, from which it is easily distinguished by its much smaller size.

Family LYCAENIDAE

Subfamily LYCAENINAE

CHRYSOPHANUS THOË (Boisduval)

Plate 8, Figures 4 to 7

Though the chances of this species being found in the District are rather remote, still it may occur here. It is to be looked for along the banks of streams and ponds and in marshy spots.

This species is easily recognized by a glance at the underside of the hind wings, which is light bluish gray, with small black spots and a broad bright red band very near the margin.

GLAUCOPSYCHE LYGDAMUS LYGDAMUS (Doubleday)

Plate 57, Figures 1, 2

This pretty little butterfly may possibly be found in the District. Although it has a very wide range it is almost everywhere a rare insect.

The color above is pale silvery or silky blue, with a narrow black border; beneath the wings are pale brownish gray, with a row of conspicuous black spots ringed with white along the inner edge of the outer third of the wings.

Subfamily THECLINAE

STRYMON LIPAROPS (Boisduval and Le Conte)

Plate 25, Figures 1, 2

The patches of scrub oak with abundant ant hills along the upper reaches of Paint Branch and elsewhere would seem to offer ideal conditions for this little butterfly, which is known from as far south as Georgia.

In general it resembles *S. calanus*, but the white lines bordering the dark bands below are as broad on the inner as on the outer side, and both interiorly and exteriorly are very irregular, not being continuous or simply crenulate as in *S. calanus*.

STRYMON EDWARDSII (Scudder)

Plate 57, Figures 5, 6

This species should occur in the District. It is to be sought for among scrub oaks, particularly in sandy areas where ant hills are numerous. It occurs southward to southwestern North Carolina.

It resembles *S. calanus*, but the inner white border of the dark bands on the undersurface of the wings is broader, and the dark bands tend to be broken up into dark spots encircled with white.

STRYMON ACADICA (Edwards)

Plate 57, Figures 7, 8

It is possible that this fine insect will be found in the District. It is to be looked for about willows along the sides of ponds and streams.

It is easily distinguished from all the other species occurring, or likely to occur, in the District. The undersurface of the wings is pearl gray marked with isolated small circular black spots ringed with white. The hind wings have two slender tails.

STRYMON CECROPS (Hübner)

Plate 23, Figures 3, 4

This species is quite likely to occur here as a casual visitor.

It is easily distinguished from all the other species mentioned herein by having on the undersurface of both wings a broad bright red line outwardly bordered with white. The color above is dark brown becoming obscurely violet-blue on the basal portion of the wings and on the inner margin of the hind wings.

STRYMON FAVONIUS (Abbot and Smith)

Plate 57, Figures 3, 4

This species, which is abundant in the South, occurs as far north as West Virginia and the coast of New Jersey. It is to be looked for in the District late in summer. In its habits, as I have observed it in Florida, it much resembles *S. calanus*.

The color above is brown with a large dull orange spot in each wing, below lighter brown with thin converging lines of white bordered with dark brown on each wing, beyond which, on the hind wings, is a large triangular patch of bright orange-red in the anterior two-thirds and a large light greenish-blue patch at the base of the tails.

ATLIDES HALESUS (Cramer)

Plate 56, Figures 5, 6

This conspicuous species is common in the South and is recorded from various places in North Carolina and Virginia, and even as far north as Cape May, N. J.

The wings above are brilliant metallic bluish green broadly margined with brown, and below are brown with a large group of brilliant metallic spots of various colors at the anal angle.

ERORA LAETA (Edwards)

Plate 25, Figures 5, 6

This very rare little butterfly is quite as likely to turn up in the District as in some of the other places where it has been found.

The color above is brown glossed with blue, and below pale fawn with a curved band of pale red spots along the inner edge of the outer fourth of the wings, and on the hind wings a second more irregular band across the middle.

INCISALIA POLIOS Cook and Watson

This species occurs from north-central Alaska (Fort Yukon) to Lake Athabasca, New Hampshire, and Nova Scotia, and southward to California, Colorado, and New Jersey. It is to be looked for in the District, flying very early in spring with *I. augustinus.*

In general *I. polios* resembles *I. augustinus*, but the underside of the fore wing has a conspicuous, though narrow, light-gray border, and the underside of the hind wing is heavily washed with grayish white scales in the outer half.

Messrs. Cook and Watson have suggested that the specimens described by Mr. Scudder as representing a varietal form of *I. irus* having the outer margin of the fore wings narrowly hoary from Norway, Me., and Needham and Walpole, Mass., are really representatives of this species.

INCISALIA MOSSI (Henry Edwards)

This western species has been recorded from the East, though not from the vicinity of the District.

It closely resembles *I. augustinus*, but is duller below. The dark inner half of the undersurface of the hind wings is bordered by a narrow white line, beyond which is an irregular lightly frosted band bounded outwardly by the row of small spots in the light outer half of the wing; the wing is margined by a fine line of white, but the area between this marginal white line and the row of spots is brown with no light scales. On the underside of the fore wing the area between the irregular line crossing the middle of the outer half of the wing and the row of small spots midway between this and the border is usually more or less frosted.

Family PAPILIONIDAE

Subfamily PIERINAE

ZERENE CAESONIA CAESONIA (Stoll)

Dog's-head Clover

Plate 28, Figure 5

There are two specimens of this species on exhibit in the District collection in the National Museum. I have never seen it in this region, nor do I know of any District specimens.

Late in summer the variety of the female of the yellow clover (*Colias philodice*) in which the outer border of the fore wings is solid black without the usual included yellow spots is easily mistaken for this butterfly.

The dog's-head clover is common in the South and has been reported from many localities north of the District, so that its occurrence here as a casual is to be expected.

PIERIS VIRGINIENSIS Edwards

Plate 56, Figures 3, 4

This butterfly is easily distinguished from the European white (*Pieris rapae*) by the absence of black spots and the absence of yellow on the underside. It is less active than the latter, with a weaker flight. There is no record of its occurrence in the District, but it is found in the high lands locally from New York to North Carolina. It may be represented in old collections from the District.

Dr. William T. M. Forbes writes me that *Pieris virginiensis* is probably distinct from *P. napi oleracea*, as it is single brooded, whereas the northern *P. n. oleracea* is double brooded. He tells me that his most northern record for *P. virginiensis* is the southern slope of the Adirondacks, while he has seen no authentic specimens of *P. n. oleracea* from south of the Mohawk Valley.

ANTHOCHARIS OLYMPIA (Edwards)

Plate 56, Figures 1, 2

This wide-ranging butterfly may possibly occur in the District. It is to be looked for early in spring with *A. genutia*, and also in more or less open country.

The color is white with black markings on the fore wings above and olive markings on the hind and fore wings below; the black crescent at the end of the cell of the fore wings above is repeated in outline below. The anterior portion of the hind wings below is tinged with pale pink.

Subfamily PAPILIONINAE

PAPILIO PALAMEDES Drury

PALAMEDES

Plate 47, Figures 1, 2

This fine swallowtail is to be looked for in the vicinity of Washington in swampy regions with an abundance of magnolias. It is common, I am informed by Dr. William Schaus, at Virginia Beach, and it has been captured in the vicinity of Philadelphia.

It is very common in the swamps of the coastal plain from Florida to North Carolina and it is locally common in eastern North Carolina and Virginia.

It resembles *P. troilus* in its irregular flight, this way and that and up and down through the swamps, but the flight is much more languid than that of *P. troilus*, with slower wing beats. Usually when in the woods the flight is rather high, 8 or 10 feet above the ground, but when crossing an open space or a road the flight is more direct and lower—4 or 5 feet above the ground.

The languid flight of this butterfly combined with the great amount of yellow on the outer half of the wings makes its identification a simple matter for anyone acquainted with the other North American black swallowtails.

Family HESPERIIDAE

Subfamily PYRGINAE

GONIURUS PROTEUS (Linnaeus)

SWALLOWTAILED SKIPPER

Plate 50, Figures 1, 2

The swallowtailed skipper is very common in the Southeastern States and ranges north along the coast to eastern Virginia and casually to New York and southern New England.

It is much less powerful and energetic than the silver-spotted skipper (*Epargyreus tityrus*), and it flies always near the ground after the fashion of the frosted skipper (*Achalarus lyciades*). Though often fast and irregular, its flight is typically slow—a curious hovering flight with the body held at an angle with the ground as if the tails were too heavy—much resembling the flight of *Poanes massasoit* and, on occasion, of *Atrytone pontiac*.

The caterpillar resembles that of the silver-spotted skipper, but is easily distinguished by being longitudinally striped. It feeds chiefly on various plants, both wild and cultivated, of the pea family (Fabaceae). In parts of the South it does much damage to crops, particularly to beans, turnips, and cabbages.

THANAOS LUCILIUS (Lintner)

Columbine Skipper

Plate 52, Figure 7

This common butterfly is not known from the District, but it must occur here, or at least it must have occurred here when the wild columbine (*Aquilegia canadensis*) was a common plant in the rocky woods about Washington. It is to be sought for, especially as a caterpillar, on cultivated columbines. It is found as far south as Raleigh, N. C., and northern Georgia.

THANAOS TERENTIUS (Scudder and Burgess)

Plate 52, Figure 3

This species, which occurs in the coastal region from Florida to Massachusetts, is to be looked for in the District.

It resembles *T. horatius*, but at the extremity of the cell of the fore wing and above it there is a distinct cinereous patch paler than the rest of the wing, and near the outer border of the wing there are cinereous clouds. The glassy spots average much smaller than in *T. horatius*, and the cellular spot is always minute or obsolete.

STAPHYLUS HAYHURSTII (Edwards)

Plate 52, Figures 15, 16

This skipper is to be looked for as a visitor to the District.

In color it is prevailingly dark brown, and it is easily distinguished from all our other dark-brown skippers by the curiously wavy margin of the hind wings, the white underside of the abdomen, and the markings as shown.

Subfamily HESPERIINAE

POLITES VIBEX BRETTUS (Boisduval)

Plate 53, Figures 15, 16

This common southern species has been taken in southern New England, and is to be looked for in the vicinity of the District.

The bright yellow and black male of this species on the upper side closely resembles the male of *Hylephila phylaeus* (compare figs. 15 and 13, pl. 53), but the markings on the underside are quite different (compare figs. 16 and 14, pl. 53).

POLITES MYSTIC (Edwards)

Plate 55, Figures 7, 8

It is quite possible that this species will eventually be found in the District.

The color above is very similar to that of *Atrytone pontiac*, but the wings below are mustard-yellow, marked as shown in the figure.

ERYNNIS ATTALUS (Edwards)

Plate 36, Figures 2, 3

This skipper occurs northward to New Jersey and casually to southern New England. It should be looked for in the District.

The color above is brown, with yellow markings much like those of *Atrytone pontiac*, though there is more yellow beyond the narrowly linear stigma on the fore wings; below, dull olive instead of rusty as in *A. pontiac*, with the markings whitish instead of dull orange and the extensive yellow patch beyond the stigma with the upper half yellow and the lower half white. The fore wings are more pointed and the hind wings narrower than in *A. pontiac*.

ERYNNIS METEA (Scudder)

Plate 55, Figures 3, 4

It is quite probable that this species will be found in the District. It occurs southward to Florida.

The color above is yellow-brown, obscurely marked with dull golden; below light olive-brown curiously marked on the hind wings and the apex of the fore wings with white as shown in the figure.

ATRYTONE BIMACULA (Grote and Robinson)

Plate 55, Figures 5, 6

This little skipper is to be looked for in the District.

The fore wings above are colored essentially as in *Atrytone pontiac*, and the hind wings are plain brown, lighter in the middle;

below the color is plain dull golden yellow, becoming dark brown on the lower half of the fore wings; just beyond the middle of the fore wings below are two conspicuous yellow spots, one much larger than the other.

ATRYTONE DION (Edwards)

Plate 55, Figures 1, 2

This species may possibly occur in the District. It has been taken on the coast of New Jersey.

The color above is very similar to that of *Atrytone pontiac*, but the wings beneath are light, dull yellow with the hind wings unmarked except for two long, broad, obscure streaks of lighter extending from the base to the outer margin.

AMBLYSCIRTES SAMOSET (Scudder)

Plate 56, Figures 9, 10

It is quite likely that this species will eventually be found in the District. It occurs southward to southwestern North Carolina.

The wings above are brown, marked with white as shown in the figure; below they are very heavily dusted with greenish gray except on the lower half of the fore wings.

AMBLYSCIRTES TEXTOR (Hübner)

Plate 58, Figures 3, 4

It is possible that this species may be found in the District. It is common not far to the southward.

The color is dark brown with a curiously intricate network of white on the underside of the hind wings and a bent line of more or less contiguous white spots on the underside of the fore wings.

POANES AARONI AARONI (Skinner)

Plate 36, Figures 4, 5

The male of this species on the upper side resembles *Poanes howardi*, but it is much smaller and the brown border of the wings is narrower. Beneath the hind wings are uniform light cinnamon and the fore wings are tawny, black at the base, and bordered with cinnamon.

Harold H. Shepard has taken this species on the eastern shore of Maryland, and it is to be looked for in the marshes bordering the Potomac.

PRENES PANOQUIN (Scudder)

Plate 9, Figures 3, 4

This inconspicuous skipper is abundant along the coast as far north as New Jersey, where it is to be found especially upon yellow composite flowers and on the buttonbush. Its flight is very rapid and irregular, and it always keeps close to the grass tops or the sand. But when resting or when feeding it is not at all shy, so that it is quite easy to catch.

This dull-colored species is easily distinguished from all the other species in our fauna by the underside of the hind wings, which are rather light olive-gray with conspicuous long whitish streaks.

ATRYTONOPSIS LOAMMI (Whitney)

Plate 55, Figures 9, 10

This species is to be sought for as a casual visitor to the District.

It is easily distinguished from all the other local skippers by the curious white markings on the otherwise uniform brown undersurface.

POSTSCRIPT

The description of *Poanes massasoit hughi* (p. 225) appeared in the Annals of the Carnegie Museum, Pittsburgh, Pa., while this memoir was in press. In a note appended to the description Dr. W. J. Holland said:

> An examination of the collections of W. H. Edwards in my possession reveals in the series of *P. massasoit* determined by Edwards, several specimens of the form *P. massasoit hughi* Clark, from Nebraska. In the Ehrmann collection bequeathed to the Carnegie Museum are three specimens of the newly named subspecies from South Dakota. It is thus shown that the var. *hughi* Clark has a wide distribution.

EXPLANATION OF PLATES

So far as possible the specimens chosen for illustration have been selected from collections made in the District area. In the case of several species, however, no District specimens suitable for illustration were available. The figures of these species have been taken from the best specimens procurable—usually in the author's collection or the collection of the United States National Museum—regardless of their place of origin.

In the explanations of the figures all the available information regarding the specimens shown is given.

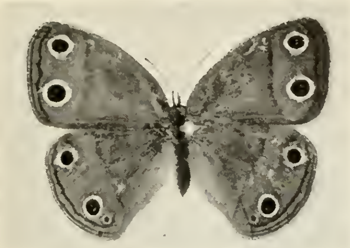
PLATE 1

FIGURES 1, 2. *Neonympha eurytus*, female, upper (1) and under (2) sides. Cabin John, Md., July 18, 1926.

3, 4. *Satyrodes eurydice*, upper (3) and under (4) sides. Beltsville, Md., July 17, 1929.

5, 6. *Satyrodes eurydice*, upper (5) and under (6) sides. Lincoln, Mass., July 7, 1923.

7, 8. *Enodia portlandia*, upper (7) and under (8) sides. Mount Tom, Mass., July 4, 1926. M. K. Morris.



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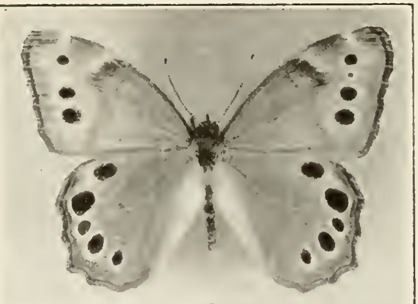

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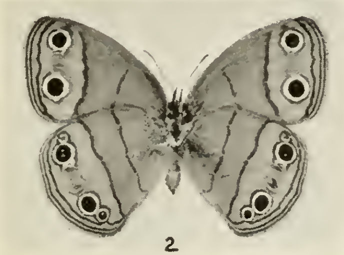

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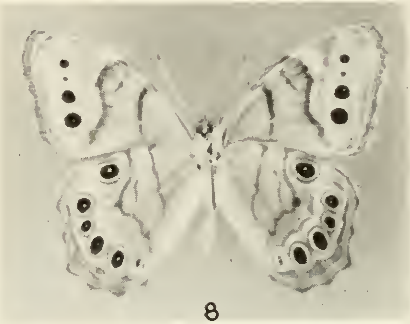

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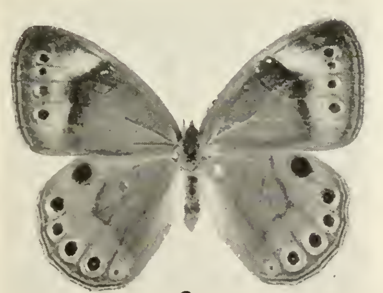

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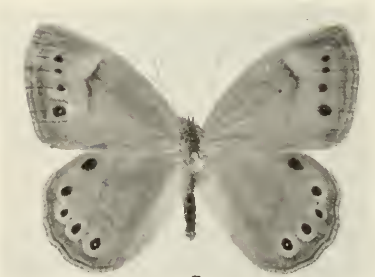

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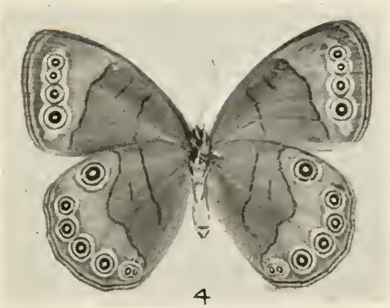

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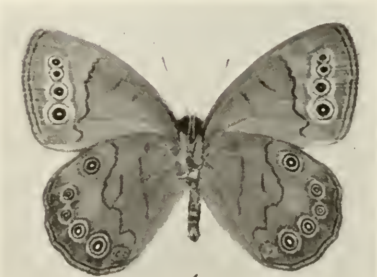

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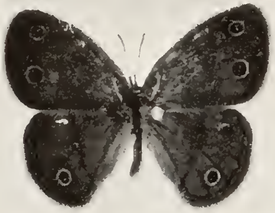
Neonympha, Satyrodes, and Enodia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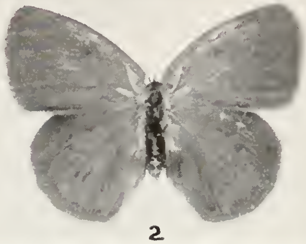
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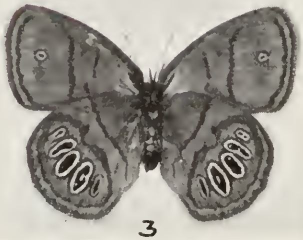
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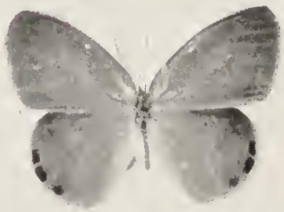
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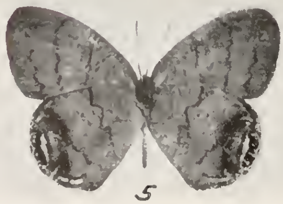
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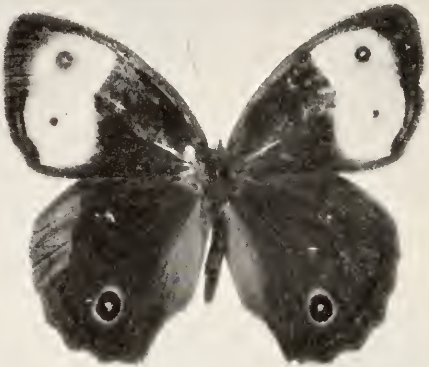
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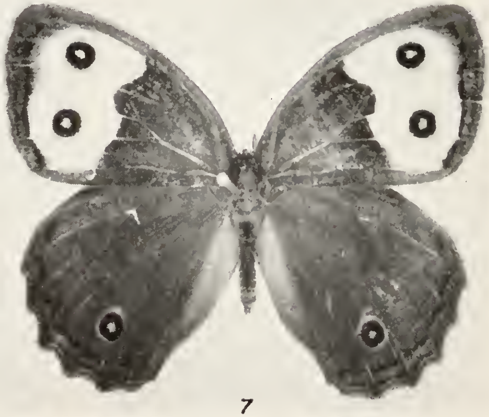
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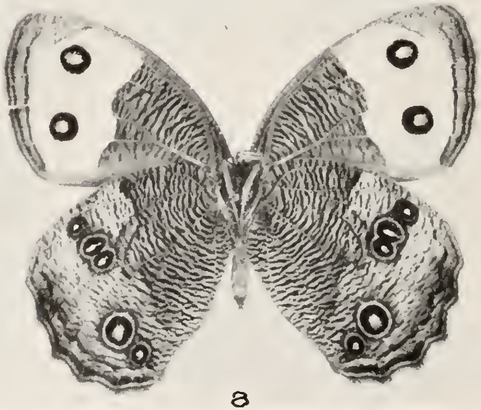
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NEONYMPHA AND CERCYONIS

PLATE 2

FIGURE 1. *Neonympha eurytus*, male, Cabin John, Md., July 18, 1926.

2, 3. *Neonympha phocion*, upper (2) and under (3) sides. Texas.

4, 5. *Neonympha gemma*, upper (4) and under (5) sides. Florida.

6. *Cercyonis alope pegala*, male, Fort Macon, N. C., August 4, 1929. H. U. Clark.

7, 8. *Cercyonis alope pegala*, female, upper (7) and under (8) sides. Fort Macon, N. C., August 4, 1929. H. U. Clark.

PLATE 3

FIGURES 1, 2. *Cercyonis alope maritima*, male, upper (1) and under (2) sides. Sitka Church, Md., July 4, 1929.

3. *Cercyonis alope alope*, female, Beltsville, Md., July 23, 1928.

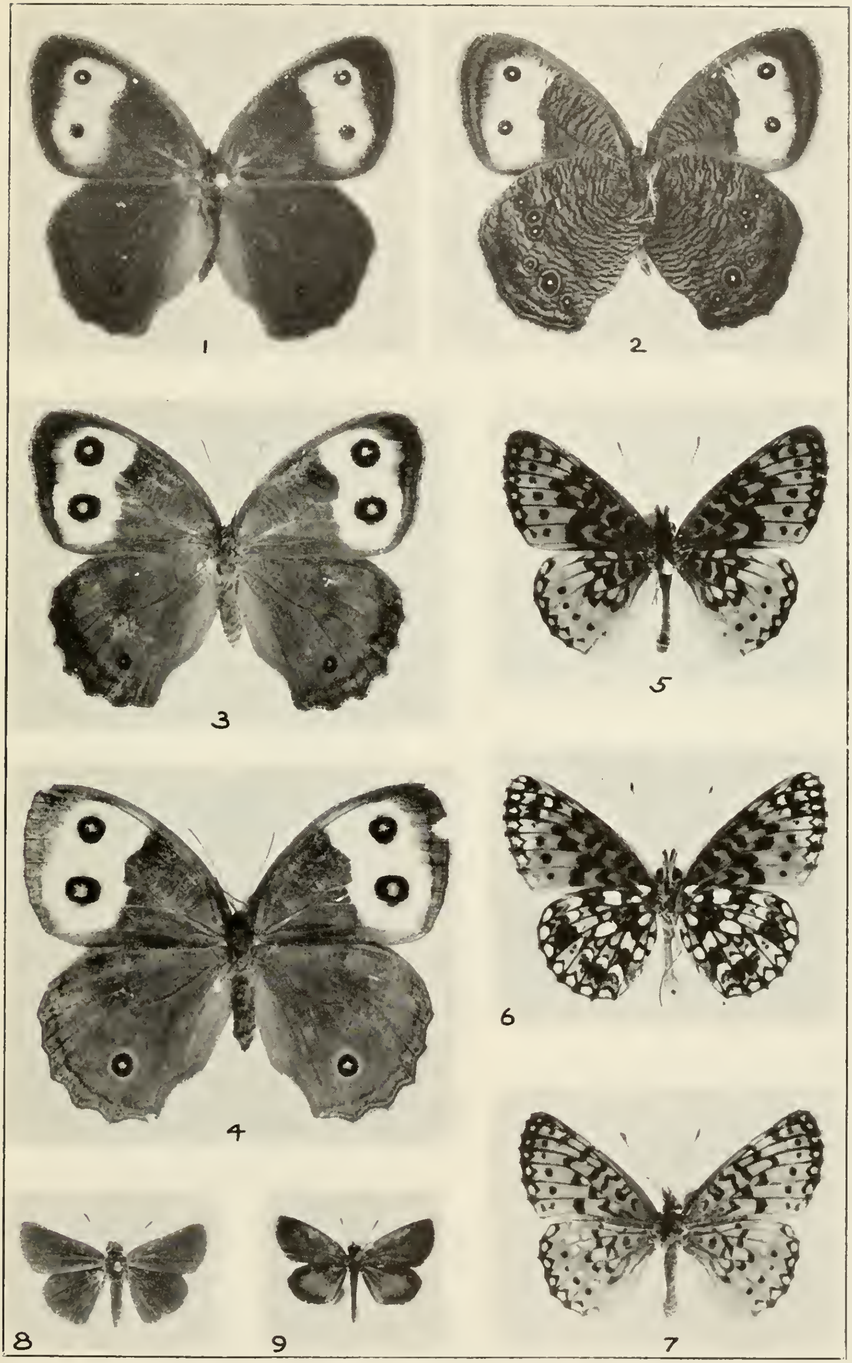
4. *Cercyonis alope*, female, white-banded form, Cabin John, Md., August 26, 1929.

5, 6. *Brenthis myrina*, upper (5) and lower (6) sides. Beltsville, Md., July 6, 1929.

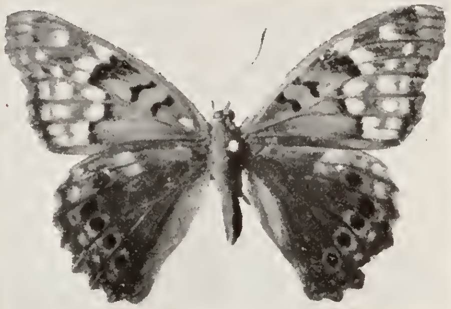
7. *Brenthis myrina*, Essex, Mass., August 12, 1925.

8. *Megistias fusca.*

9. *Ancyloxypha numitor*, Newtonville, Mass., August 17, 1923.



Cercyonis, Brenthis, Megistias, and Ancyloxypha



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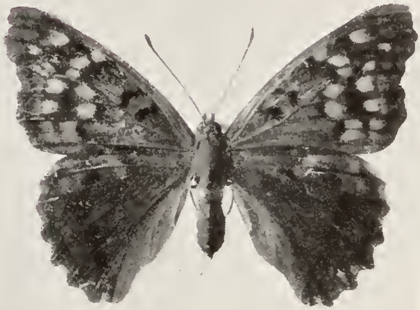

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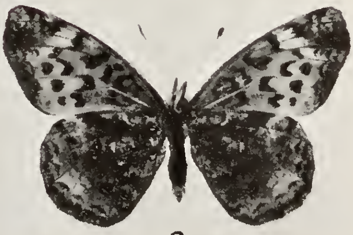

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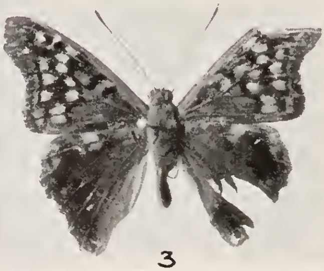

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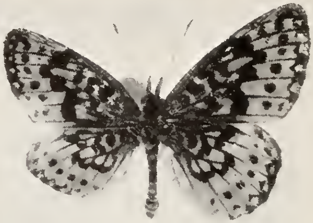

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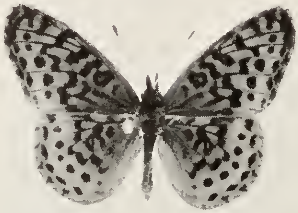

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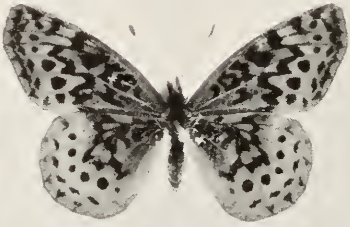

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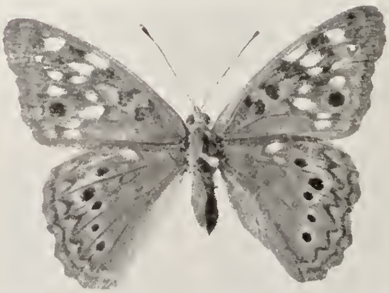


4

CHLORIPPE AND BRENTHIS

PLATE 4

FIGURE 1. *Chlorippe clyton clyton*, female, light form, Cabin John, Md., September 11, 1926.

2. *Chlorippe clyton clyton*, female, dark form, Cabin John, Md., September 8, 1926.

3. *Chlorippe clyton clyton*, male, dark form, Cabin John, Md., September 11, 1926.

4. *Chlorippe celtis celtis*, Cabin John, Md., September 11, 1926.

5. *Brenthis myrina*, abnormal, Beltsville, Md., July 6, 1929.

6. *Brenthis bellona*, male, Essex, Mass., August 8, 1925.

7, 8. *Brenthis bellona*, female, upper (7) and under (8) sides. Essex, Mass., August 30, 1925.

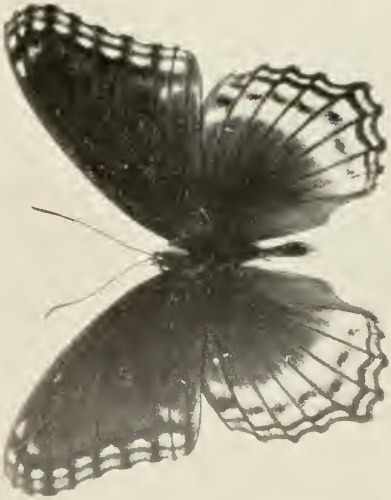
PLATE 5

FIGURES 1, 2. *Basilarchia arthemis astyanax*, upper (1) and under (2) sides. Silver Spring, Md., September 11, 1928.

3, 4. *Basilarchia arthemis astyanax*, upper (3) and under (4) sides. Essex, Mass., August 12, 1925.

5. *Feniseca tarquinius*, Newtonville, Mass.

6, 7, 8. *Feniseca tarquinius;* larvae from Weston, Mass.: emerged at Newtonville, Mass., August 22, 1923.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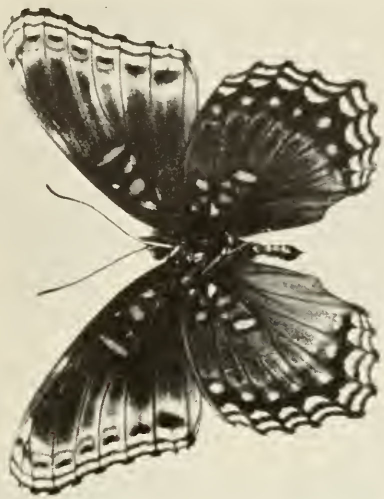
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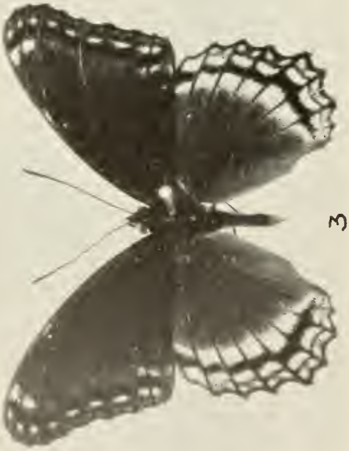
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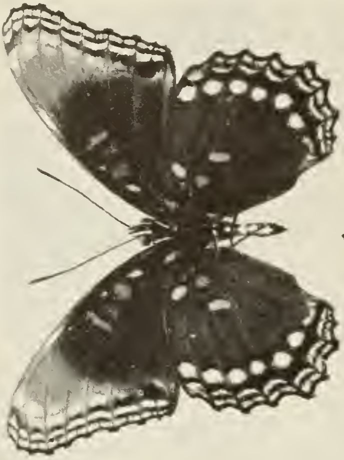
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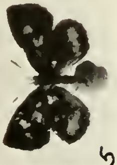
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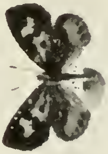
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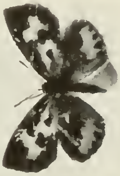
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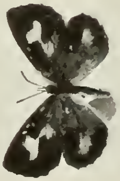
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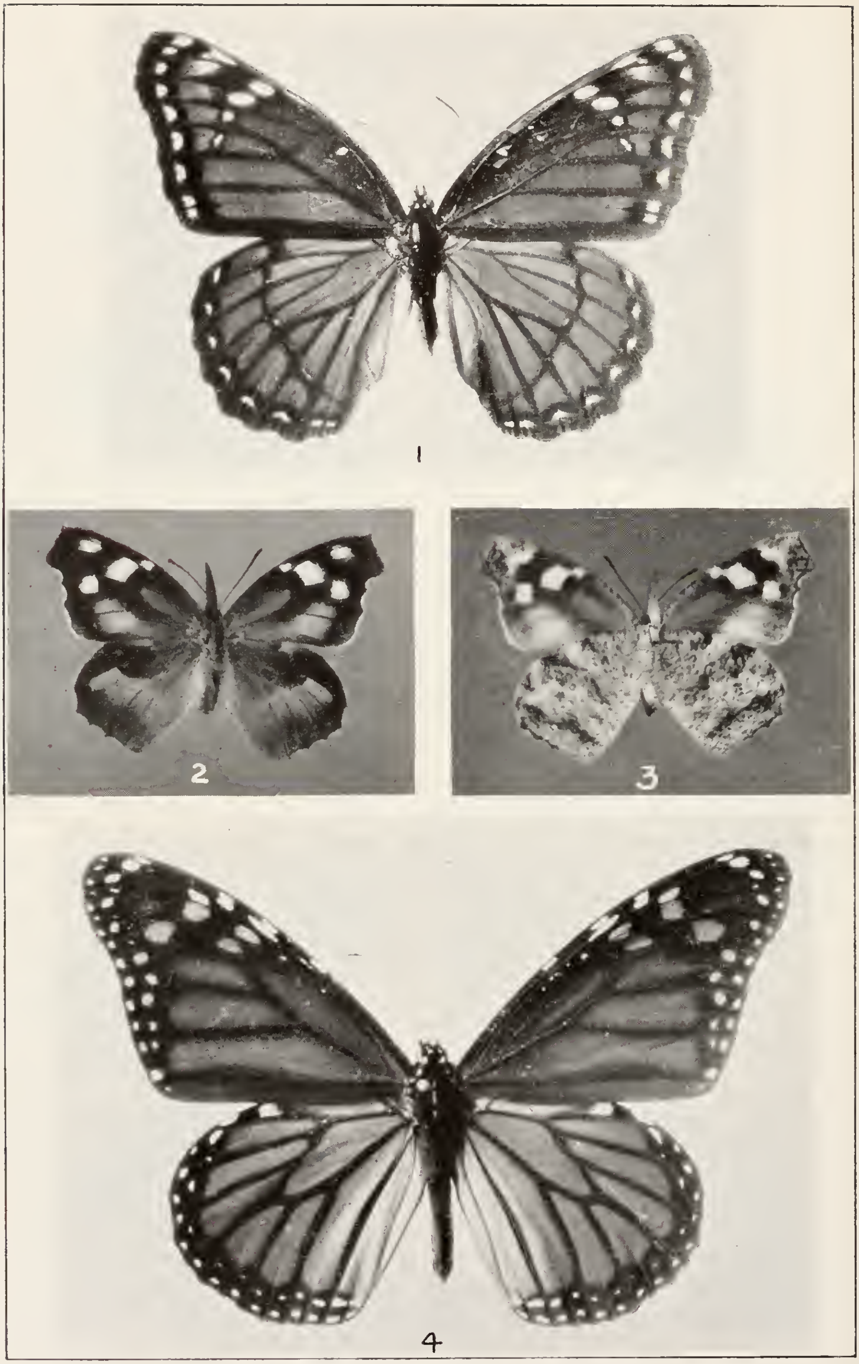
BASILARCHIA AND FENISECA



Basilarchia, Libythea, and Danaus

PLATE 6

FIGURE 1. *Basilarchia archippus archippus*, Silver Spring, Md., September 10. 1928.

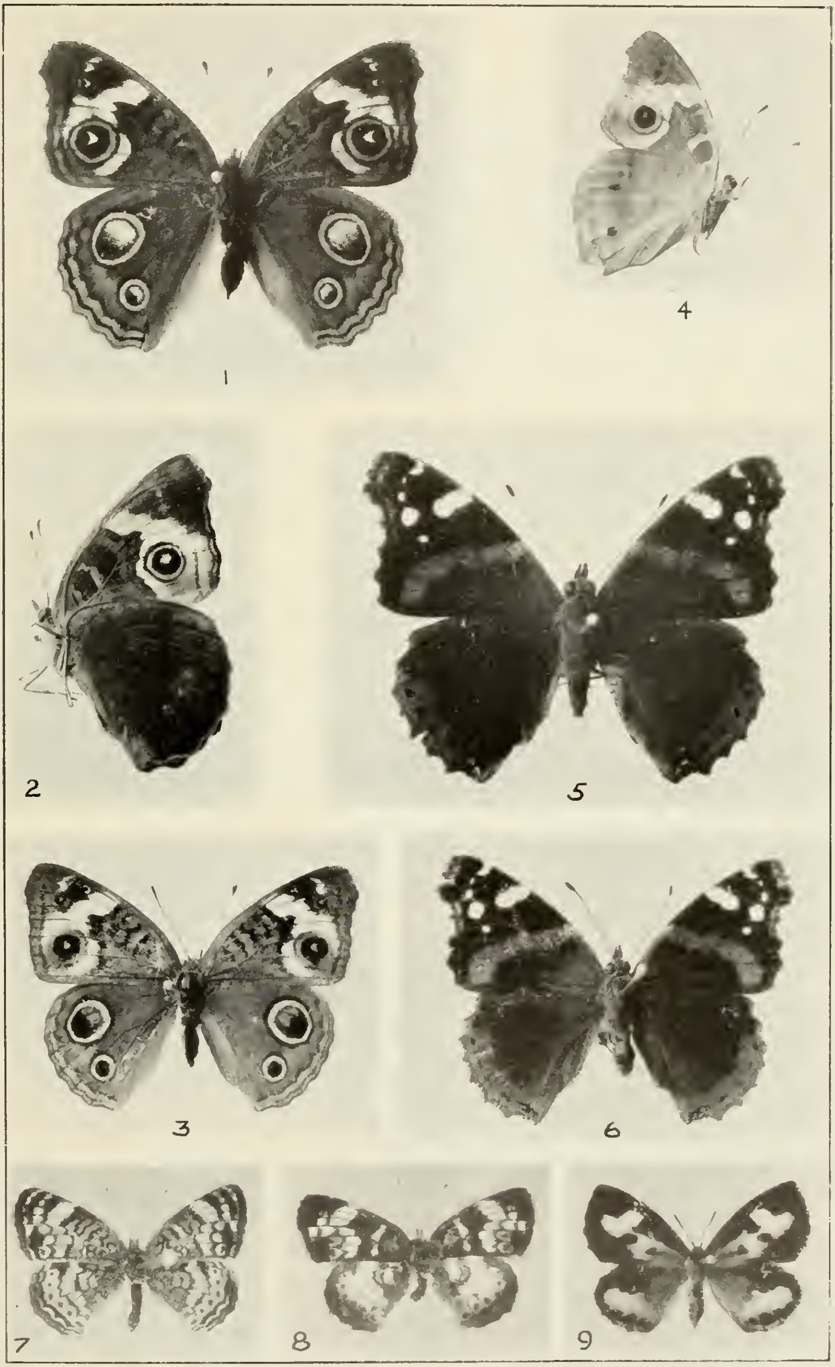
2, 3. *Libythea bachmanii*, upper (2) and under (3) sides. Cotulla, Tex.. May 11, 1906. J. C. Crawford.

4. *Danaus plexippus*, female, Cabin John. Md., October 13, 1928.

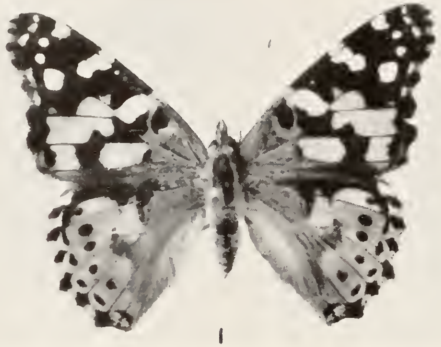
Plate 7

Figure 1. *Junonia lavinia coenia*, female, wet form, Cabin John, Md., September 27, 1925.

2. *Junonia lavinia coenia*, female, wet form, underside, Cabin John, Md., September 10, 1925.
3. *Junonia lavinia coenia*, female, dry form, Cabin John, Md., September 19, 1925.
4. *Junonia lavinia coenia*, male, dry form, underside, Cabin John, Md., August 1, 1927.
5. *Pyrameis atalanta*, female, wet form, Cabin John, Md., August 27, 1926.
6. *Pyrameis atalanta*, female, dry form, Cabin John, Md., June 2, 1926.
7. *Phyciodes tharos*, female, Cabin John, Md., May 10, 1925. Underside of same specimen shown on Plate 13, Figure 5.
8. *Phyciodes tharos*, male, unusually dark, Silver Spring, Md., July 7, 1928.
9. *Feniseca tarquinius;* larva from Weston, Mass.; emerged at Newtonville, Mass., August 16, 1923.



JUNONIA, PYRAMEIS, PHYCIODES, AND FENISECA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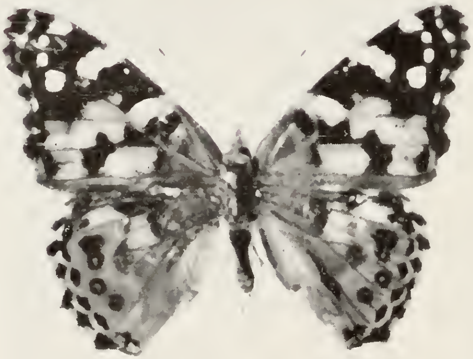
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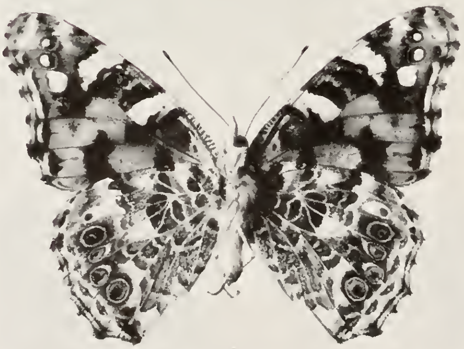
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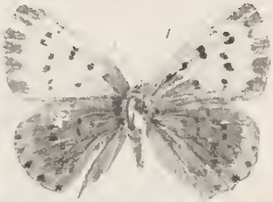
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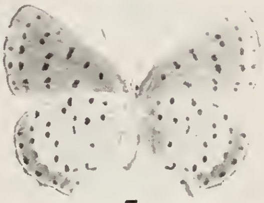
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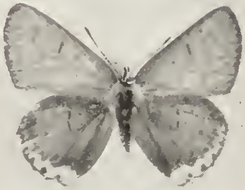
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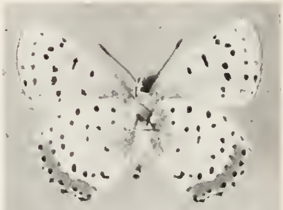
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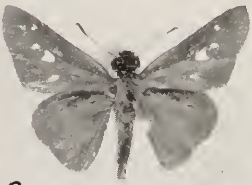
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Pyrameis, Chrysophanus, and Prenes

PLATE 8

FIGURE 1. *Pyrameis cardui*, female, Cabin John, Md., June 25, 1926.

2, 3. *Pyrameis cardui*, form *jacksoni*, female, upper (2) and under (3) sides. Essex, Mass., August 4, 1924.

4, 5. *Chrysophanus thoë*, female, upper (4) and under (5) sides. Essex, Mass., September 1, 1925. A. B. J. Clark.

6, 7. *Chrysophanus thoë*, male, upper (6) and under (7) sides. Detroit, Mich., June 7, 1927. G. W. Rawson.

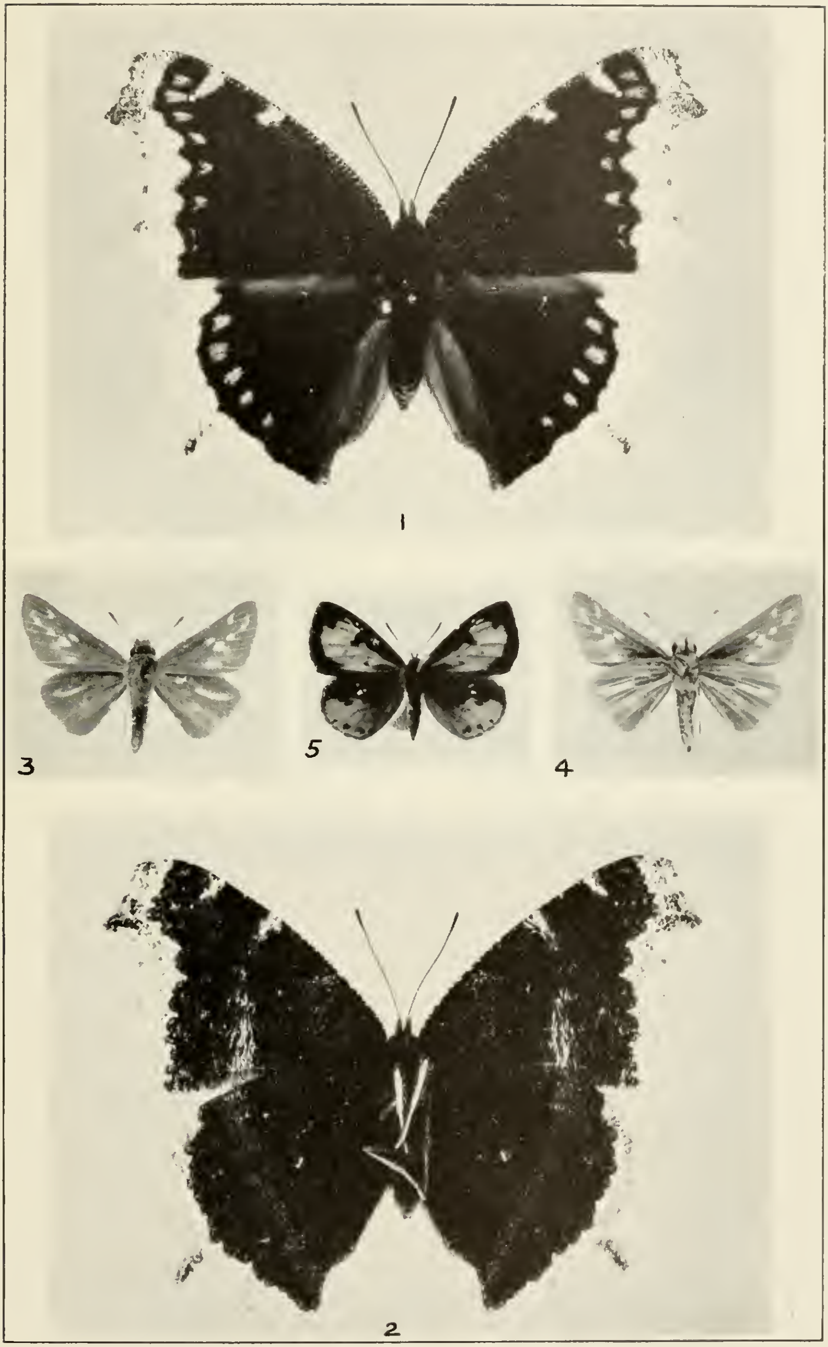
8. *Prenes ocola*.

PLATE 9

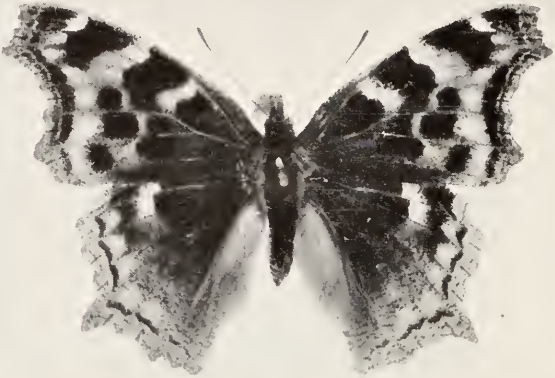
FIGURES 1, 2. *Vanessa antiopa*, female, upper (1) and under (2) sides. Cabin John, Md., September 1, 1929.

3, 4. *Prenes panoquin*, upper (3) and under (4) sides, Anglesea, N. J., June, 1923.

5. *Feniscca tarquinius;* larva from Weston, Mass.; emerged at Washington, D. C., November 19, 1923.



Vanessa antiopa, Prenes panoquin, and Feniseca tarquinius



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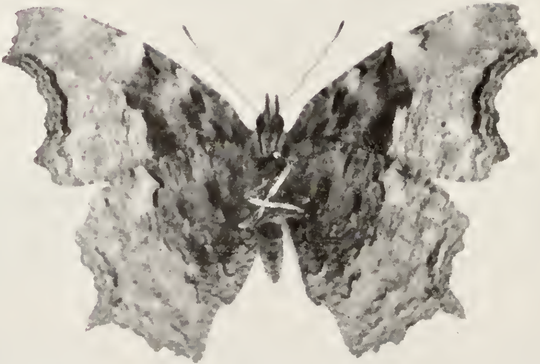

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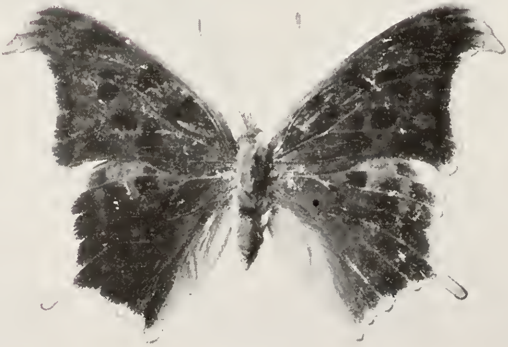


3

VANESSA J-ALBUM AND POLYGONIA INTERROGATIONIS

PLATE 10

FIGURES 1, 2. *Vanessa j-album*, upper (1) and under (2) sides. O. Meske, October 7, 1870. The usual silver mark on the underside of the hind wings is lacking.

3. *Polygonia interrogationis*, Cabin John, Md., October 2, 1927.

PLATE 11

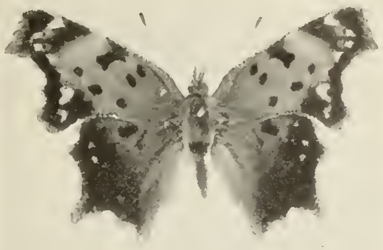
FIGURES 1, 2. *Polygonia progne*, male, upper (1) and under (2) sides. O. Meske, September 24, 1872.

3, 4. *Polygonia comma*, female, light form, upper (3) and under (4) sides. Cabin John, Md., October 21, 1929.

5, 6. *Polygonia faunus*, upper (5) and under (6) sides. Greenfield, N. H., August 21, 1923.

7. *Euphydryas phaëton*, male, Cabin John, Md., June 20, 1926.

8. *Euphydryas phaëton*, female, underside, Cabin John, Md., June 22, 1926.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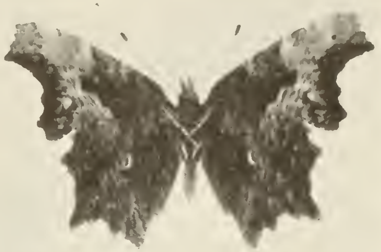
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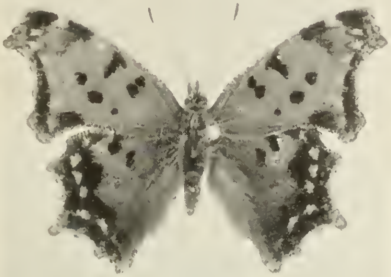
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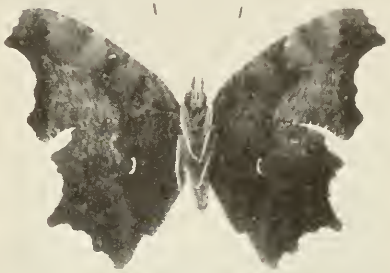
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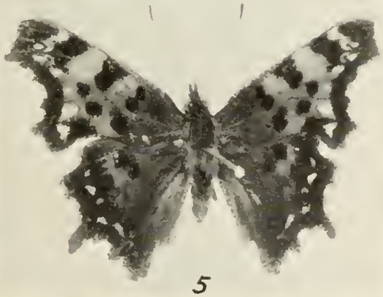
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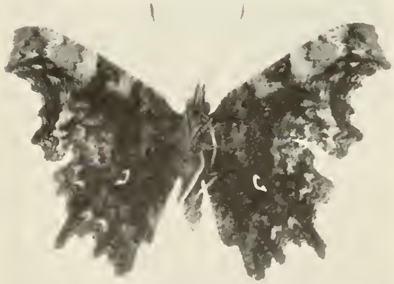
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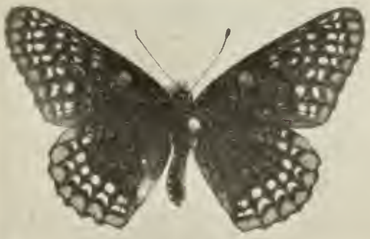
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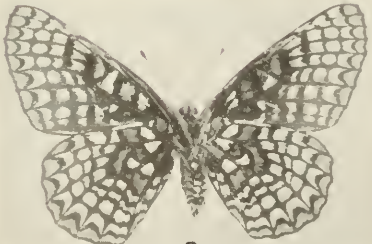
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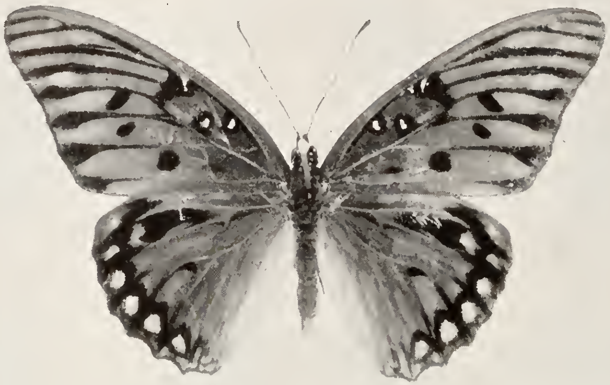
Polygonia and Euphydryas



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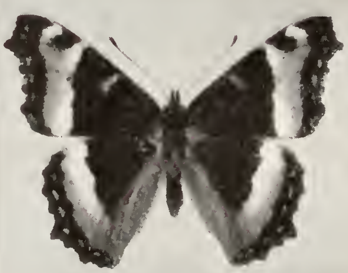

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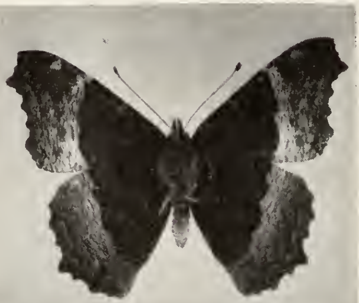

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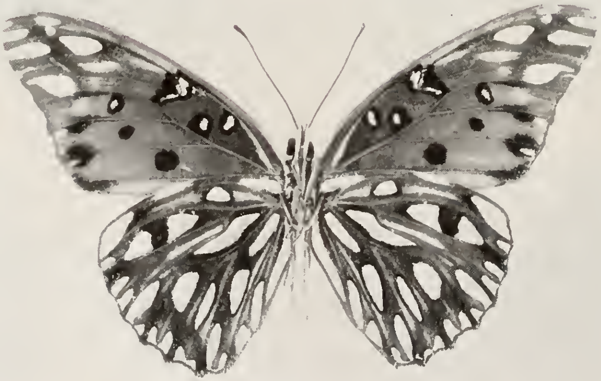


2

DIONE VANILLAE AND VANESSA MILBERTI

PLATE 12

FIGURES 1, 2. *Dione vanillae incarnata*, upper (1) and under (2) sides. Fernandina, Fla., August 7, 1929. H. U. Clark.

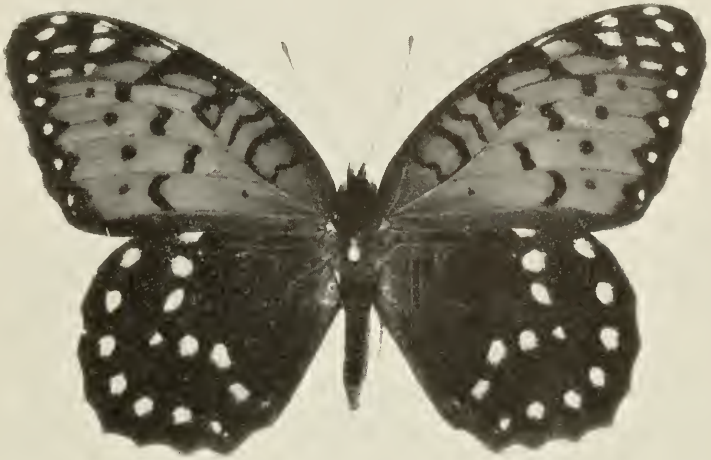
3, 4. *Vanessa milberti*, male. upper (3) and under (4) sides. Detroit, Mich., September 15, 1926. G. W. Rawson.

PLATE 13

FIGURES 1, 2. *Argynnis idalia*, female, upper (1) and under (2) sides. Cabin John, Md., July 17, 1926.

3, 4. *Phyciodes batesii*, upper (3) and under (4) sides. O. Meske, June 6, 1876.

5. *Phyciodes tharos*, female, underside. Cabin John, Md., May 10, 1925. Upper side of same specimen shown on Plate 7, Figure 7.



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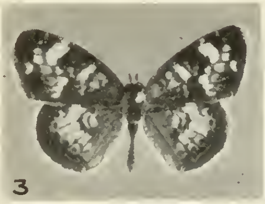

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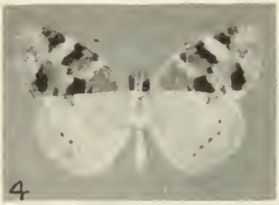

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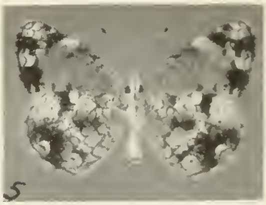

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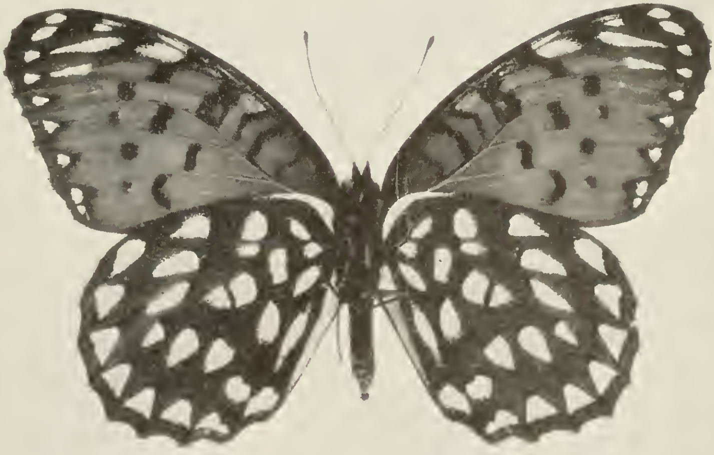

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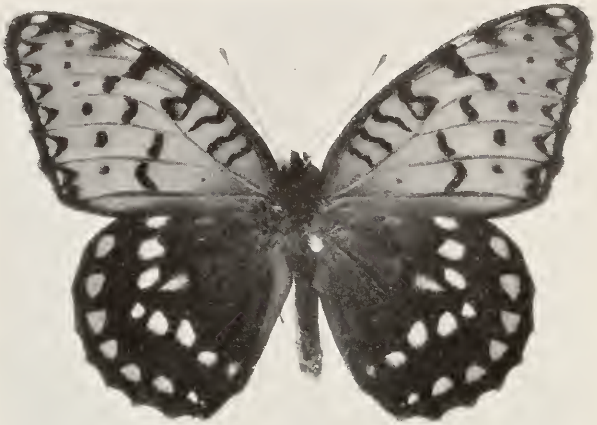
ARGYNNIS IDALIA AND PHYCIODES



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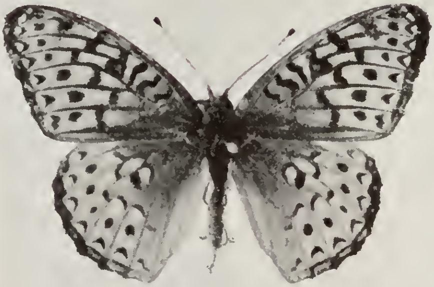

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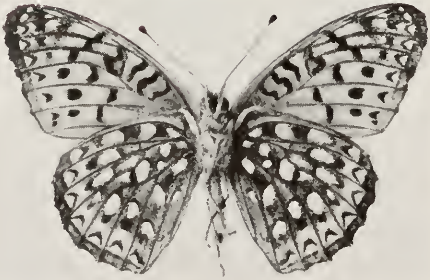

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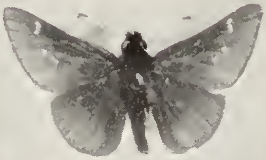

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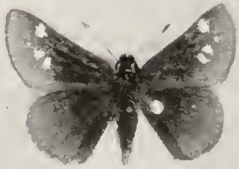

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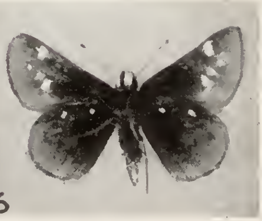


6

ARGYNNIS IDALIA, A. ATLANTIS, AND ATRYTONOPSIS HIANNA

PLATE 14

FIGURE 1. *Argynnis idalia*, male, Silver Spring, Md., June 16, 1929.

2, 3. *Argynnis atlantis*, male, upper (2) and under (3) sides. Essex, Mass.

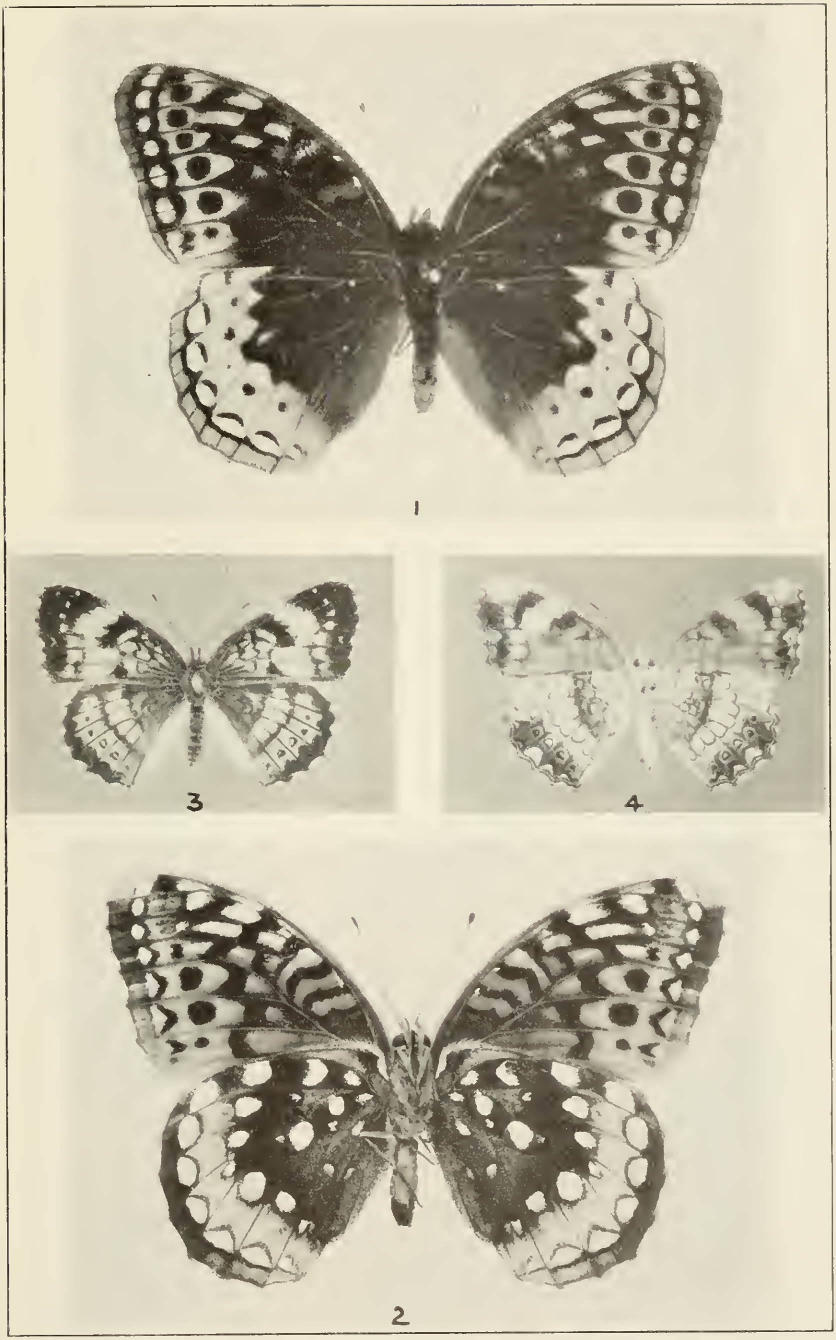
4. *Atrytonopsis hianna*, male. O. Meske, June 9, 1874.

5, 6. *Atrytonopsis hianna*, female, upper (5) and under (6) sides. Cabin John, Md., June 2, 1929.

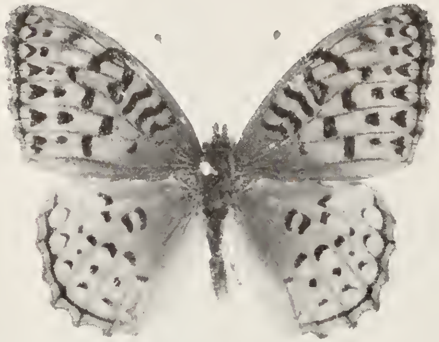
PLATE 15

FIGURES 1, 2. *Argynnis cybele*, female, upper (1) and under (2) sides. Rock Creek Park, D. C., June 23, 1923.

3, 4. *Phyciodes nycteis*, female. O. Meske, July 2, 1870.



ARGYNNIS CYBELE AND PHYCIODES NYCTEIS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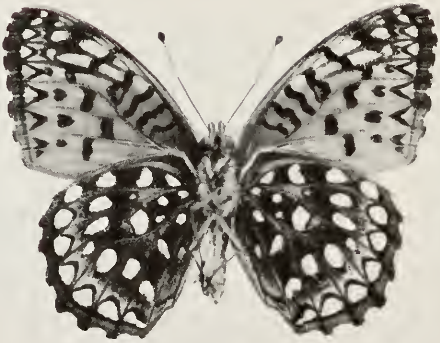
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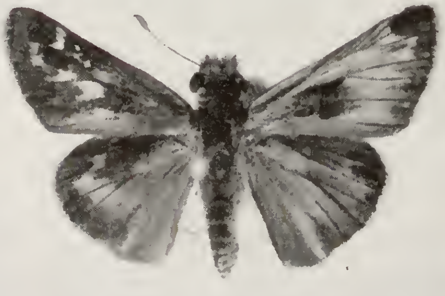
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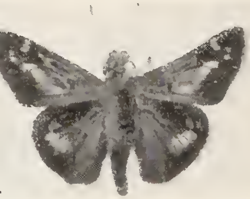
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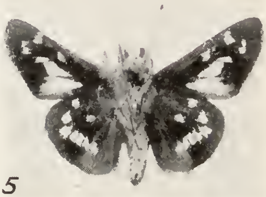
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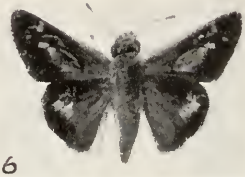
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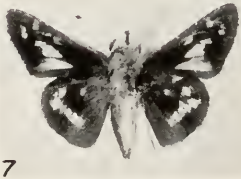
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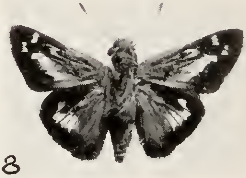
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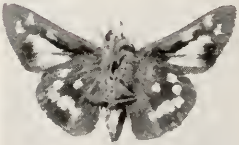
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Argynnis, Erynnis, and Atalopedes

PLATE 16

FIGURES 1, 2. *Argynnis aphrodite*, male, upper (1) and under (2) sides. Newtonville, Mass., July 9, 1923.

3. *Atalopedes campestris*, right-side male, left-side female. Cabin John, Md., July 25, 1926. × 2. See Plate 35, Figures 2 to 5.

4, 5. *Erynnis leonardus*, male, upper (4) and under (5) sides. Silver Spring, Md., September 10, 1928.

6, 7. *Erynnis leonardus*, male, upper (6) and under (7) sides. Silver Spring, Md., September 11, 1928.

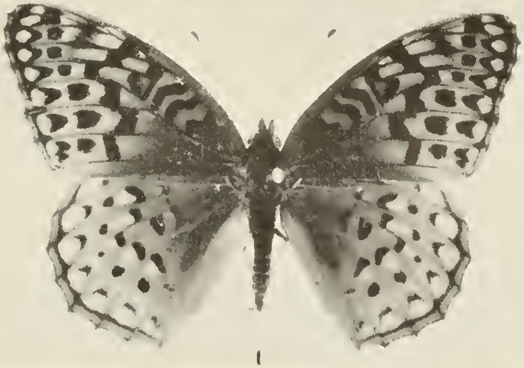
8, 9. *Erynnis leonardus*, male, upper (8) and under (9) sides. Newtonville, Mass., August 28, 1923.

PLATE 17

FIGURES 1, 2. *Argynnis aphrodite*, female, upper (1) and under (2) sides. Newtonville, Mass., July 11, 1923.

3, 4. *Erynnis leonardus*, female, upper (3) and under (4) sides. Silver Spring, Md., September 14, 1928.

5, 6. *Erynnis leonardus*, female, upper (5) and under (6) sides. Newtonville, Mass., August, 1923.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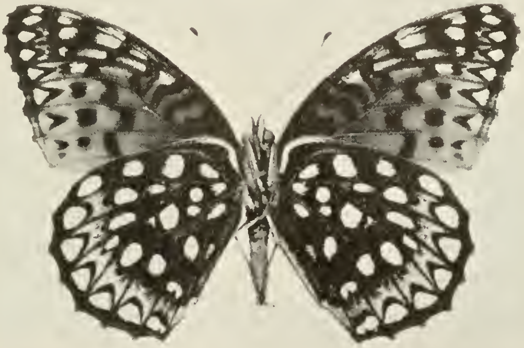
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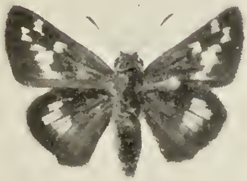
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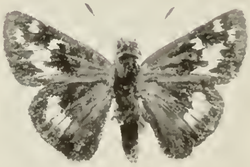
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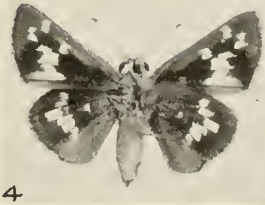
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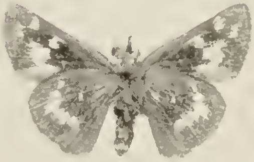
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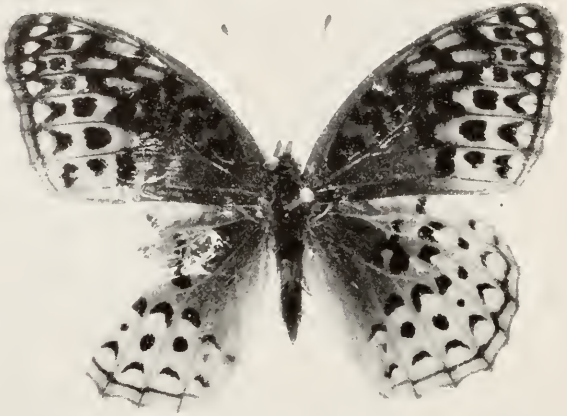
ARGYNNIS APHRODITE AND ERYNNIS LEONARDUS



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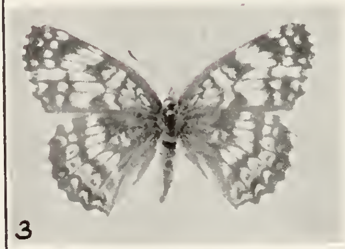

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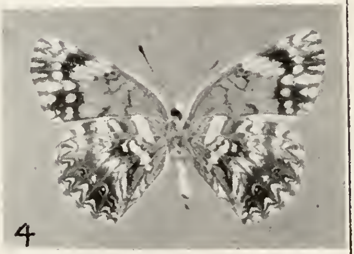

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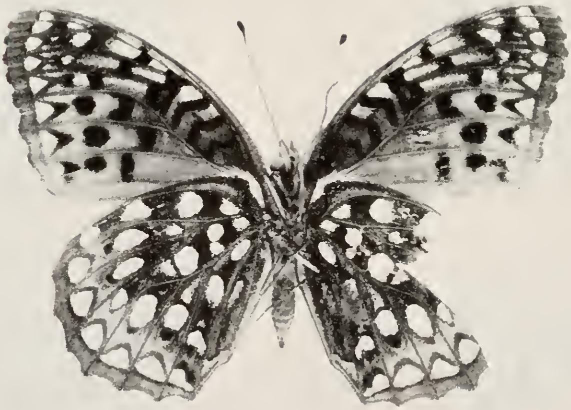


2

Argynnis aphrodite and Phyciodes carlota

PLATE 18

FIGURES 1, 2. *Argynnis aphrodite*, female, upper (1) and under (2) sides. Silver Spring, Md., August 10, 1927.

3, 4. *Phyciodes cartota.* Glasgow, Mont. Harrison G. Dyar, September 11, 1921.

PLATE 19

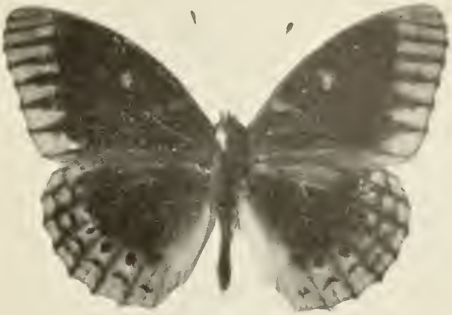
FIGURES 1, 2. *Argynnis aphrodite*, ab. *bakeri*, upper (1) and under (2) sides. Waynesburg, Ohio, July 2, 1927. Clement W. Baker.

3. *Phyciodes tharos*, with abnormal left hind wing. Cabin John, Md., July 25, 1926. A. B. J. Clark. × 2.

4, 5. *Atrytone logan logan*, male, upper (4) and under (5) sides. Newtonville, Mass., August 16, 1923.

6, 7. *Atrytone logan logan*, female, upper (6) and under (7) sides. Newtonville, Mass., August 16, 1923.

8, 9. *Atrytone logan logan*, female, upper (8) and under (9) sides. Beltsville, Md., July 23, 1928.



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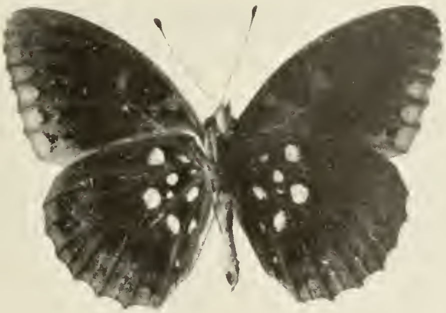

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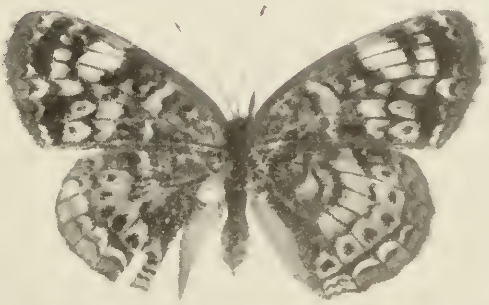

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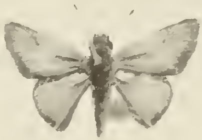

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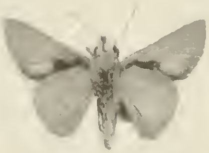

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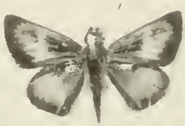

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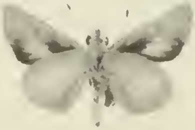

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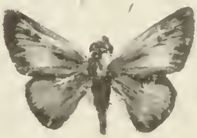

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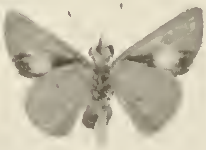

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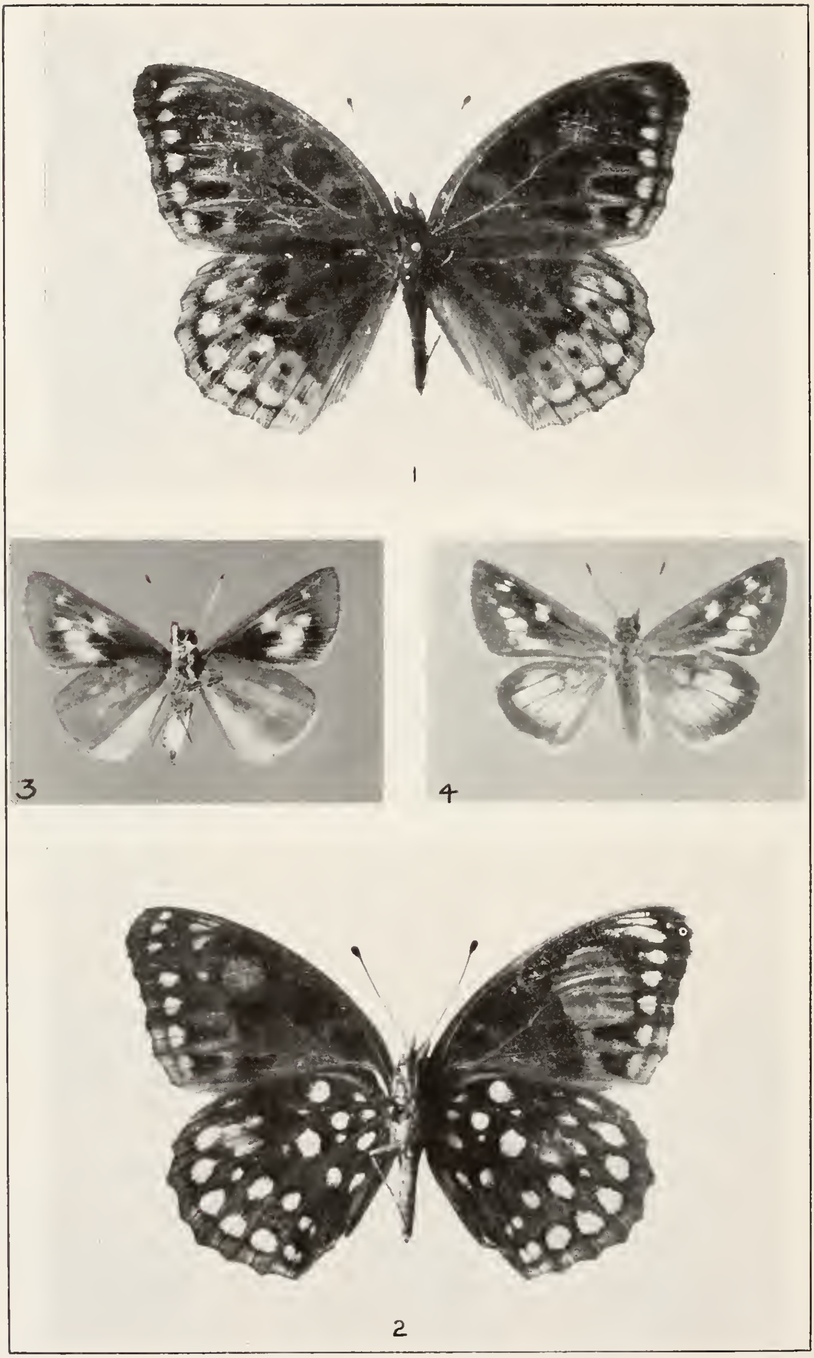
ARGYNNIS, PHYCIODES, AND ATRYTONE



ARGYNNIS APHRODITE AND POANES VIATOR

PLATE 20

FIGURES 1, 2. *Argynnis aphrodite*, melanistic female, upper (1) and under (2) sides. White Sulphur Springs, W. Va., July 27, 1896. Col. Wirt Robinson.

3, 4. *Poanes viator*, female, upper (3) and under (4) sides. Newark, N. J.

PLATE 21

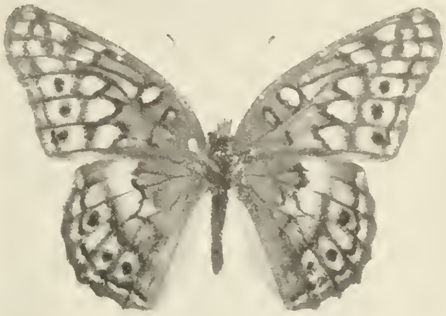
FIGURES 1, 2. *Euptoieta claudia*, female, upper (1) and under (2) sides. Silver Spring, Md., August 1, 1927.

3. *Phoebis eubule eubule*, male.

4, 5. *Atrytone vestris*, male, upper (4) and under (5) sides. Jamesburg, N. J., August 4, 1907.

6, 7. *Catia otho egeremet*, male, upper (6) and under (7) sides. St. Louis, Mo., August 1, 1877. C. V. Riley.

8, 9. *Erynnis sassacus sassacus*, male, under (8) and upper (9) sides. Mystic, Conn., June 1, 1924.



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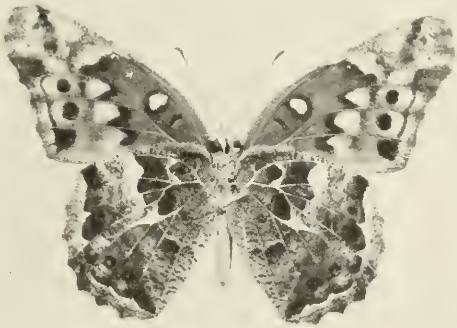

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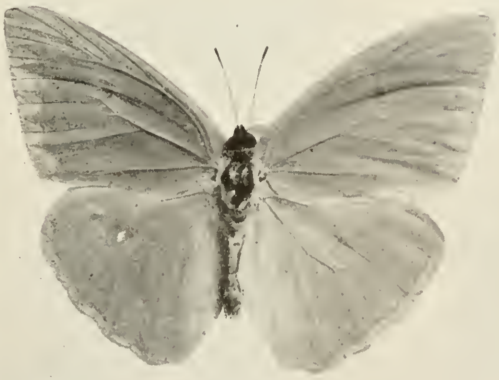

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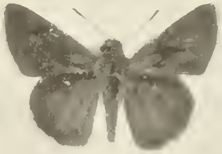

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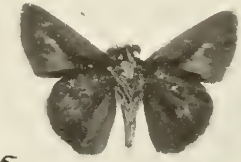

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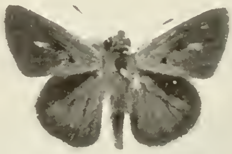

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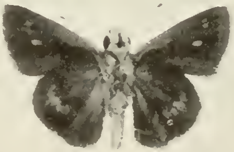

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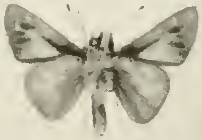

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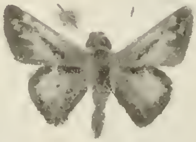

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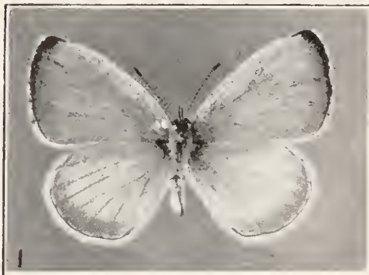
EUPTOIETA PHOEBIS, ATRYTONE, CATIA, AND ERYNNIS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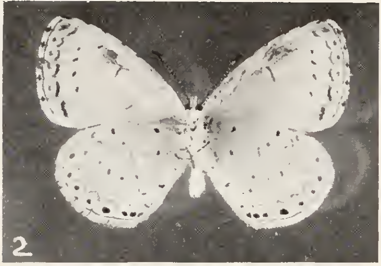
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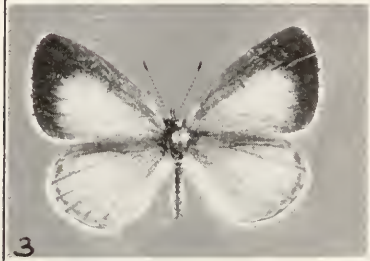
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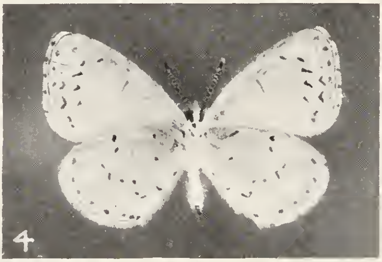
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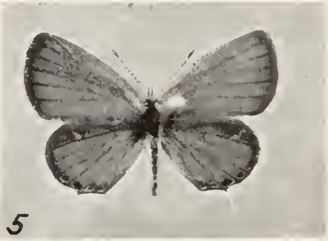
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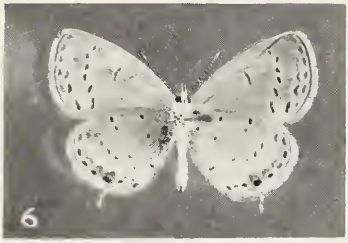
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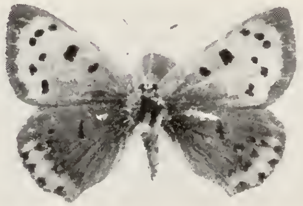
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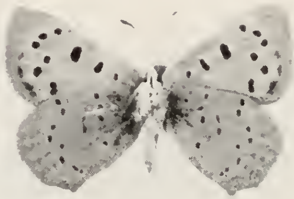
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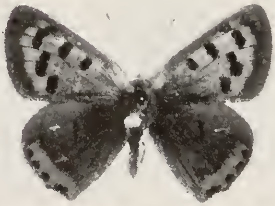
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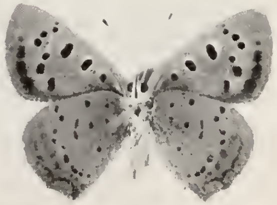
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LYCAENOPSIS, EVERES, AND CHRYSOPHANUS

PLATE 22

(All figures × 1½)

FIGURES 1, 2. *Lycaenopsis argiolus pseudargiolus*, male, upper (1) and under (2) sides. Beltsville, Md., July 9, 1928.

3, 4. *Lycaenopsis argiolus pseudargiolus*, female, upper (3) and under (4) sides. Cabin John, Md., June 16, 1929.

5, 6. *Everes comyntas*, male, upper (5) and under (6) sides. Cabin John, Md., June 16, 1928.

7, 8. *Chrysophanus phlaeas hypophlaeas*, upper (7) and under (8) sides. Rock Creek Park, D. C., May 6, 1923.

9, 10. *Chrysophanus phlaeas hypophlaeas*, upper (9) and under (10) sides. Beltsville, Md., September 7, 1929.

PLATE 23

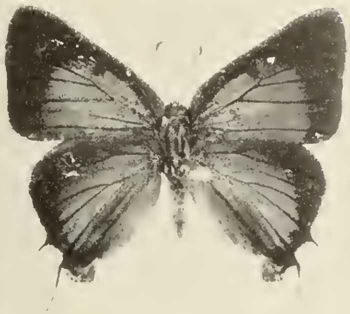
(All figures × 1½)

FIGURES 1, 2. *Strymon m-album*, upper (1) and under (2) sides. Silver Spring, Md., September 2, 1927.

3, 4. *Strymon cecrops*, upper (3) and under (4) sides. Mexico, 1924.

5, 6. *Strymon melinus melinus*, female, upper (5) and under (6) sides. Silver Spring, Md., August 27, 1926.

7, 8. *Strymon ontario ontario*, female, upper (7) and under (8) sides. May 31, 1872.



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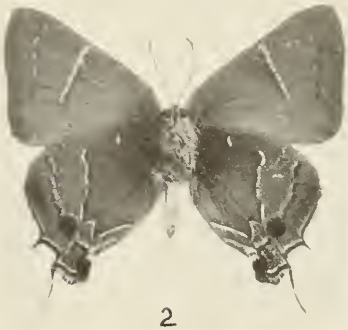

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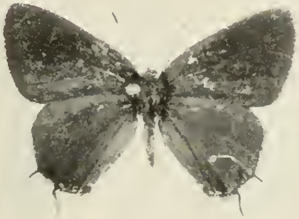

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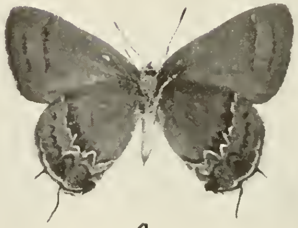

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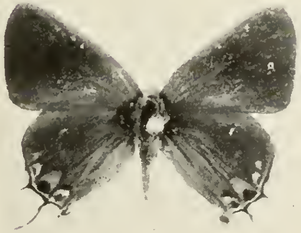

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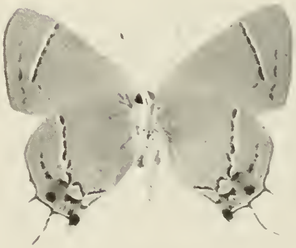

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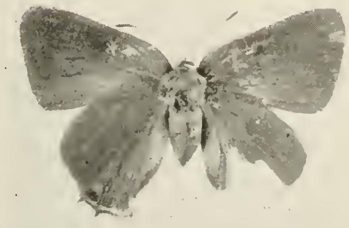

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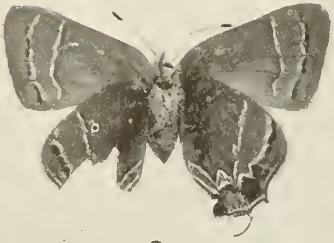

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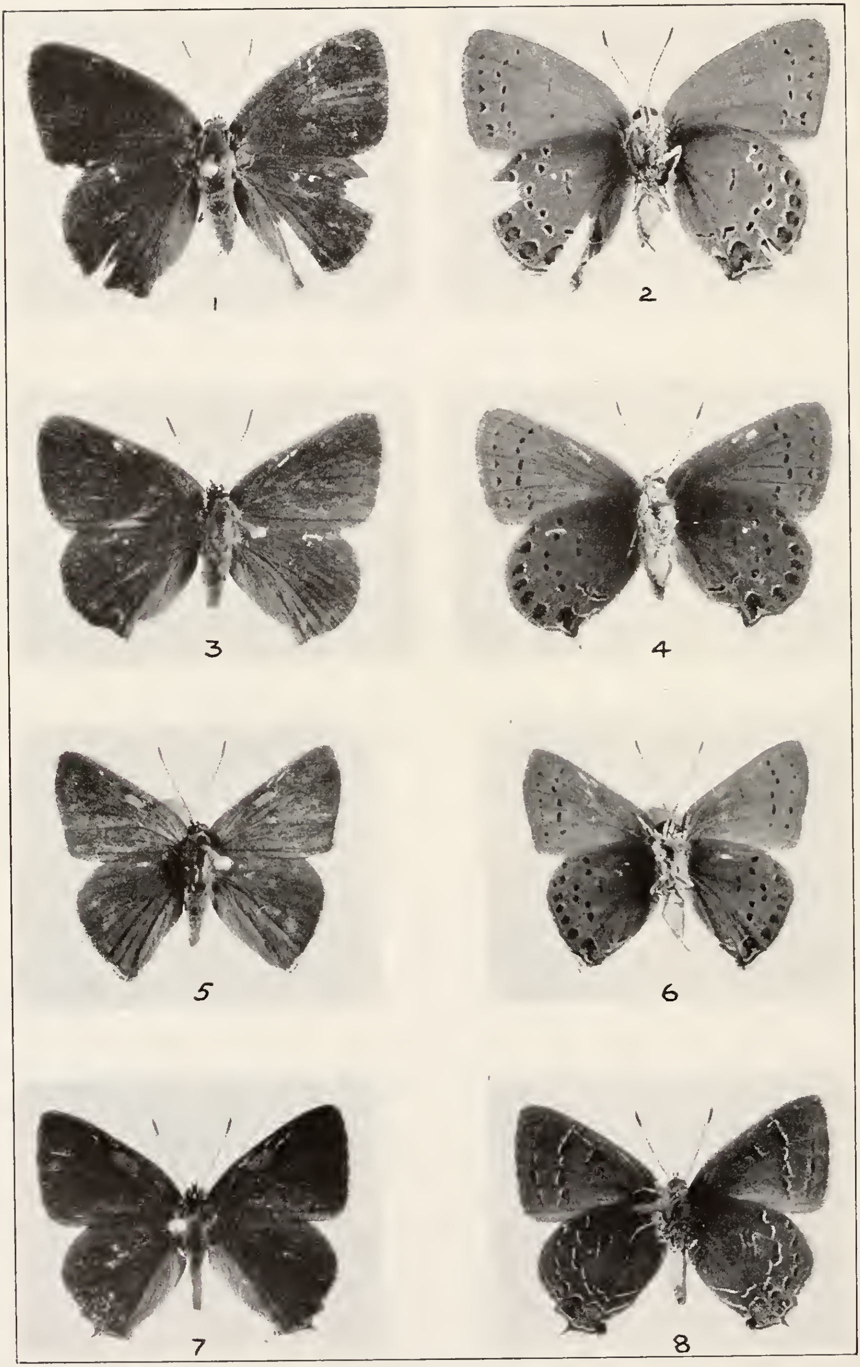
STRYMON M-ALBUM, S. CECROPS, S. MELINUS, AND S. ONTARIO



STRYMON TITUS AND S. CALANUS

Plate 24

(All figures × 1½)

Figures 1, 2. *Strymon titus mopsus*, female, upper (1) and under (2) sides. Chain Bridge flats, D. C., June 30, 1923.

3, 4. *Strymon titus titus*, female, upper (3) and under (4) sides. Needham, Mass., July 22, 1923.

5, 6. *Strymon titus titus*, male, upper (5) and under (6) sides. Needham, Mass., July 22, 1923.

7, 8. *Strymon calanus*, male, upper (7) and under (8) sides. Essex, Mass., July 9, 1925.

PLATE 25

(All figures × 1½)

FIGURES 1, 2. *Strymon liparops*, male, upper (1) and under (2) sides. Essex, Mass., July 7, 1925.

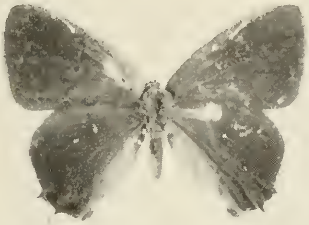
3, 4. *Mitoura gryneus gryneus*, male, upper (3) and under (4) sides.

5, 6. *Erora laeta*, male, upper (5) and under (6) sides. Prescott, Ariz.

7. *Incisalia augustinus*, underside. Newtonville, Mass., 1895.

8. *Incisalia irus*, underside. Arkansas.

9, 10. *Incisalia niphon*, upper (9) and under (10) sides. May 12, 1871.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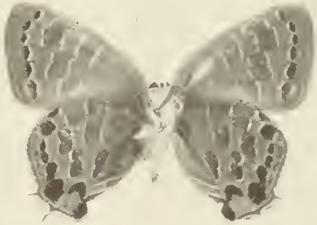
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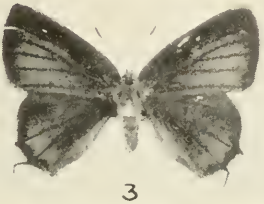
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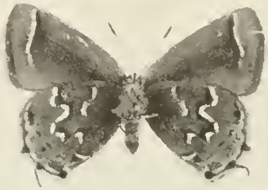
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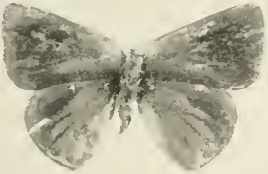
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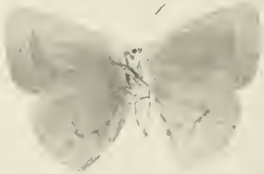
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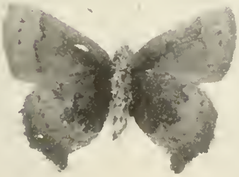
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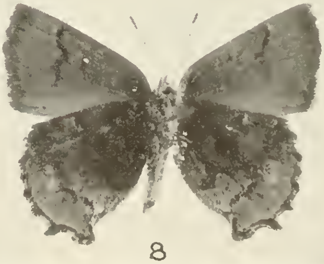
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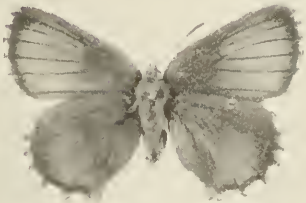
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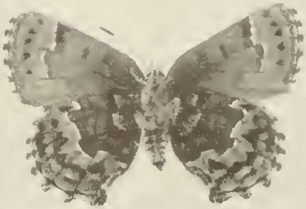
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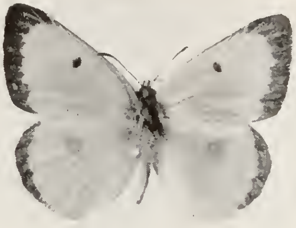
STRYMON, MITOURA, ERORA, AND INCISALIA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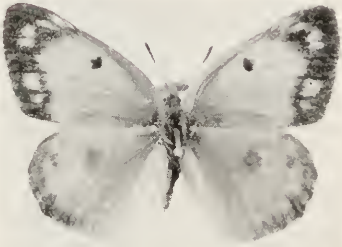
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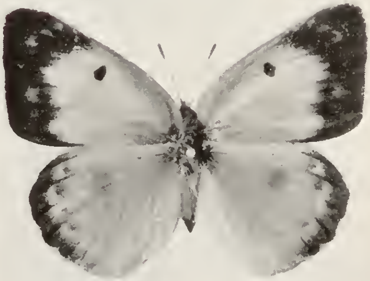
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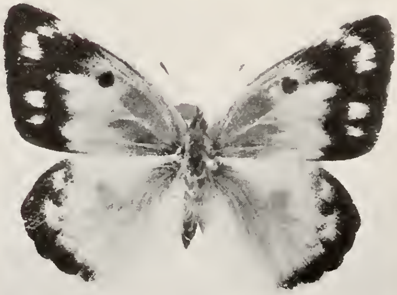
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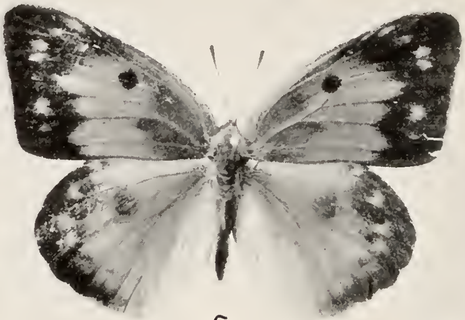
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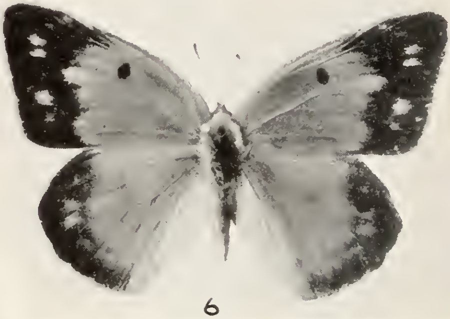
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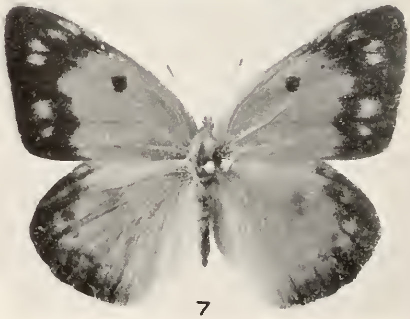
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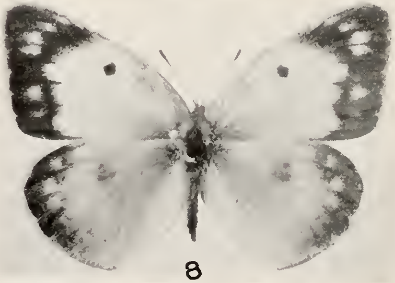
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COLIAS EURYTHEME

PLATE 26

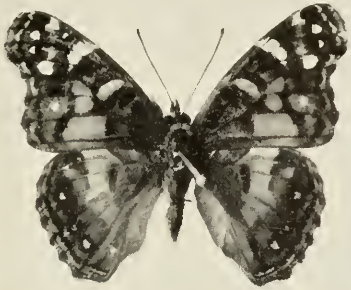
Colias eurytheme

FIGURE 1. Form *ariadne*, male, Silver Spring, Md., July 23, 1927.

2. Form *ariadne*, female, Silver Spring, Md., August 6, 1927.
3. Yellow female with a barely perceptible orange flush on the discal portion of the fore wings; Cabin John, Md., September 14, 1928.
4. White female, Cabin John, Md., September 19, 1925.
5. Very large female, Cabin John, Md., September 11, 1928.
6. Very large female, Cabin John, Md., September 14, 1928.
7. Female with the spots in the back margin of the fore wings orange; Cabin John, Md., October 7, 1928.
8. White female flushed with pink on the discal portion of the fore wings and with yellow on the hind wings; Cabin John, Md., October 7, 1928.

PLATE 27

FIGURE 1. *Pyrameis virginiensis*, male, Cabin John, Md., September 11, 1926.
2. *Pyrameis virginiensis*, female, underside, Cabin John, Md., September 11, 1926.
3. *Colias philodice*, male, Silver Spring, Md., September 2, 1927.
4. *Colias philodice*, large male, Silver Spring, Md., August 3, 1927.
5. *Colias philodice*, female, without light spots in the black margin of the fore wings; Silver Spring, Md., September 11, 1929.
6. *Colias philodice*, late-spring female, Cabin John, Md., May 9, 1926.
7. *Colias philodice*, early-spring female. Cabin John, Md., May 2, 1926.
8. *Colias philodice*, white female without light spots in the black margin of the fore wings; Essex, Mass., August 29, 1925.



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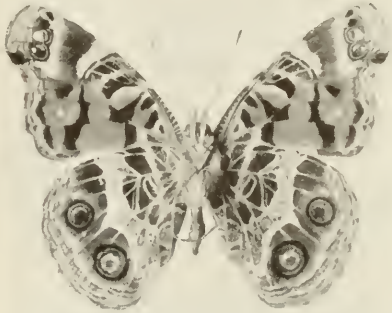

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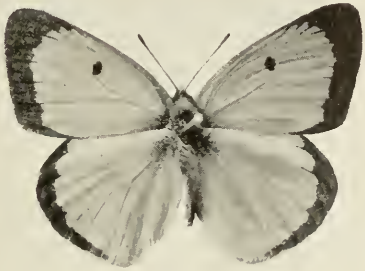

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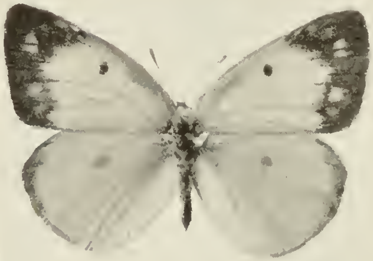

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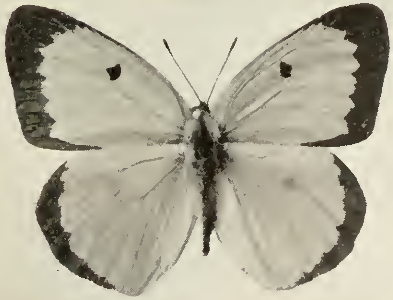

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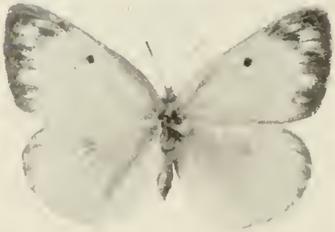

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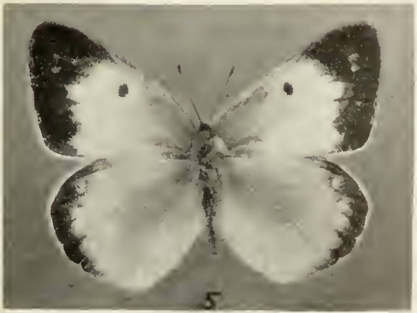

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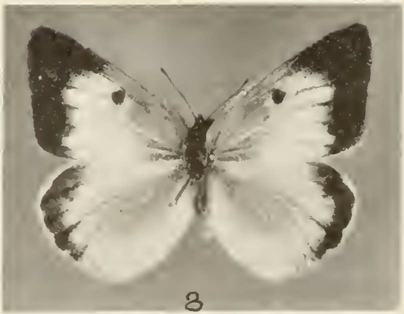

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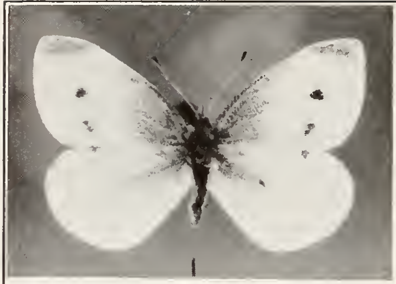
PYRAMEIS VIRGINIENSIS AND COLIAS PHILODICE



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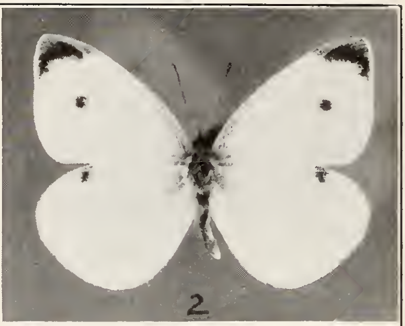

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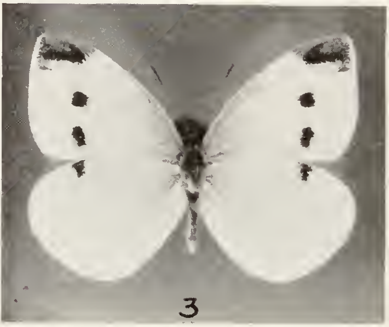

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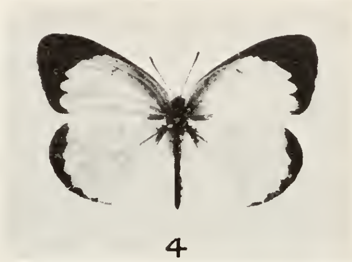

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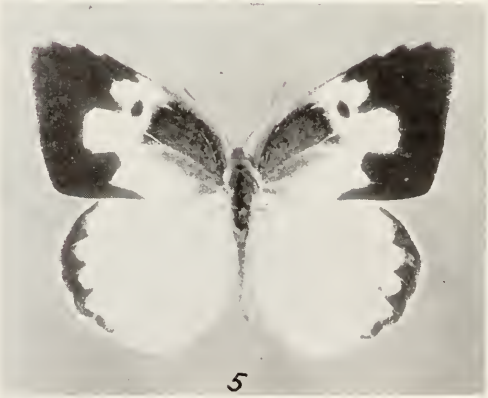

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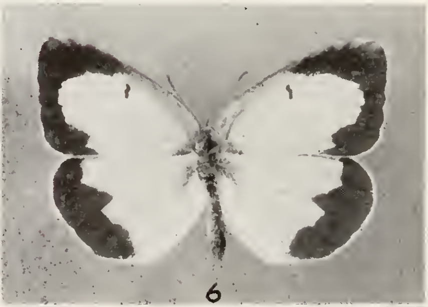

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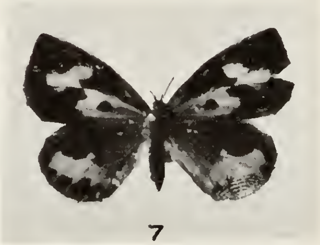

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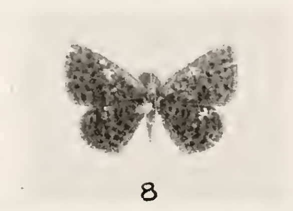

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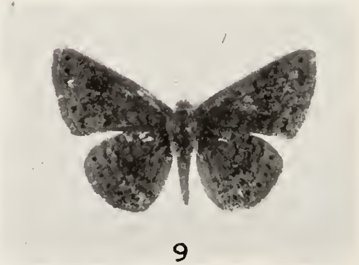


9

PIERIS, EUREMA, ZERENE, FENISECA, AND CHARIS

PLATE 28

FIGURE 1. *Pieris rapae*, early-spring female; Cabin John, Md., April 8, 1925.
2. *Pieris rapae*, summer male, Cabin John, Md., September 21, 1928.
3. *Pieris rapae*, summer female, Cabin John, Md., September 21, 1928.
4. *Eurema lisa*, male.
5. *Zerene caesonia caesonia*, Cotulla, Tex. F. C. Pratt.
6. *Eurema nicippe nicippe*, male, Kansas.
7. *Feniseca tarquinius*, unusually large female, Newtonville, Mass.
8. *Charis virginiensis*, Miami, Fla. × 1½.
9. *Charis borealis*, Kerrville, Tex. H. Lacy. × 1½.

PLATE 29

FIGURE 1. *Anthocharis genutia*, early-spring male; Cabin John, Md., April 13, 1925.

2. *Anthocharis genutia*, early-spring form of female; Cabin John, Md., May 2, 1926.

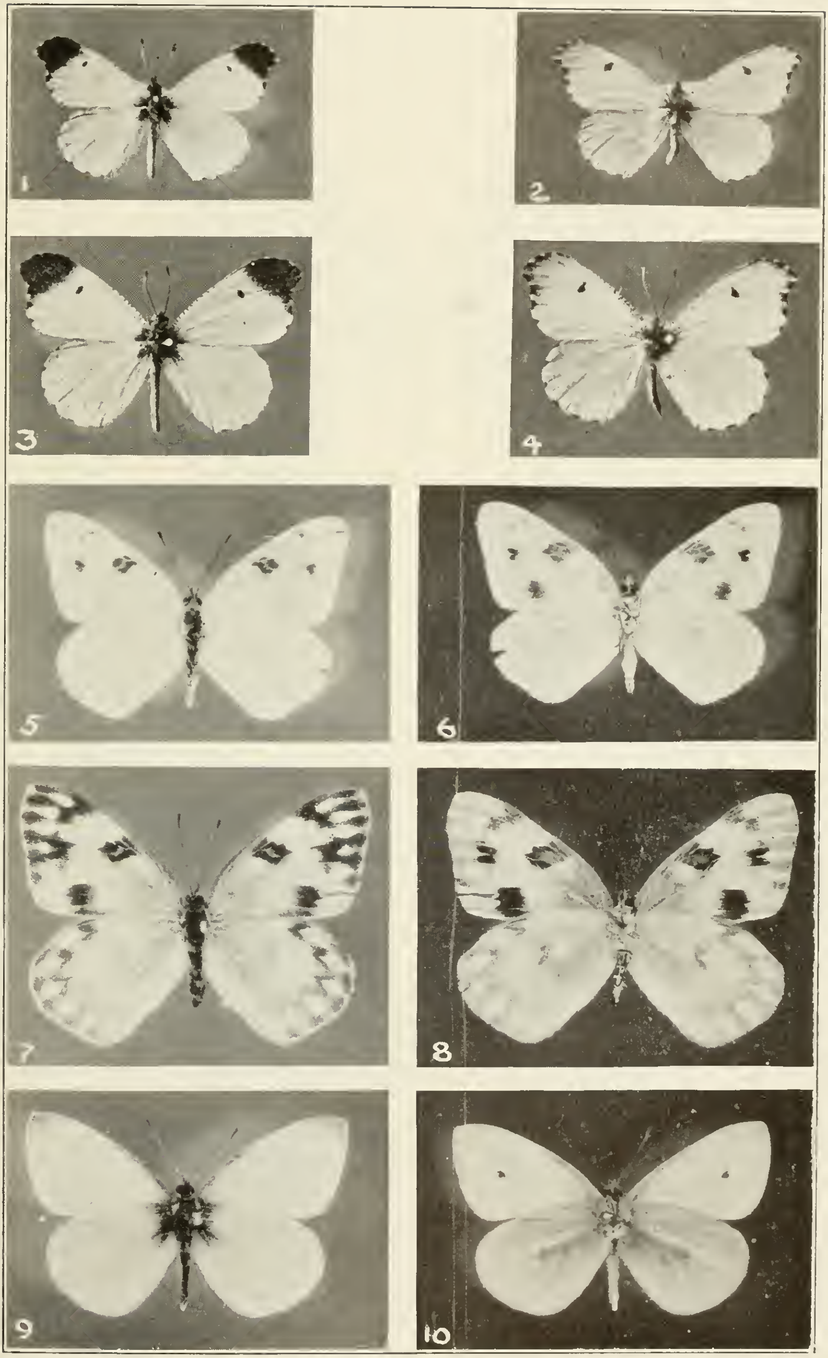
3. *Anthocharis genutia*, late form of male; Cabin John, Md., May 2, 1926.

4. *Anthocharis genutia*, late form of female; Cabin John, Md., May 2 1926.

5, 6. *Pieris protodice*, male, upper (5) and under (6) sides. Cabin John, Md., July 25, 1926.

7, 8. *Pieris protodice*, female, upper (7) and under (8) sides. Cabin John, Md., September 27, 1925.

9, 10. *Pieris rapae*, male, spring form, upper (9) and under (10) sides. Cabin John, Md., April 8, 1925.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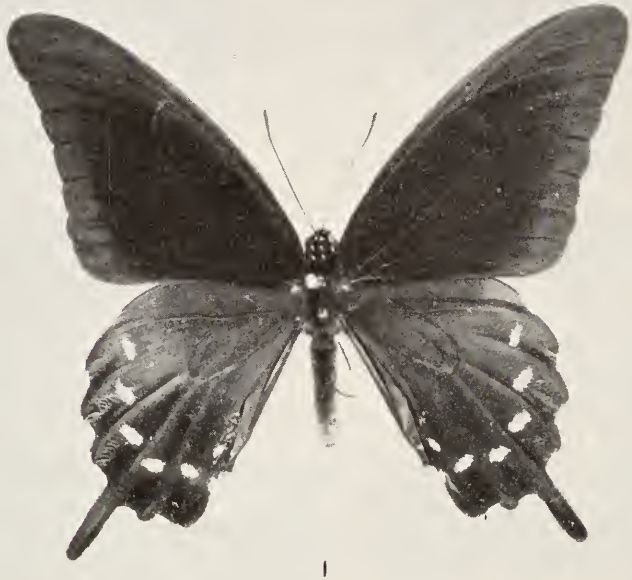
ANTHOCHARIS AND PIERIS



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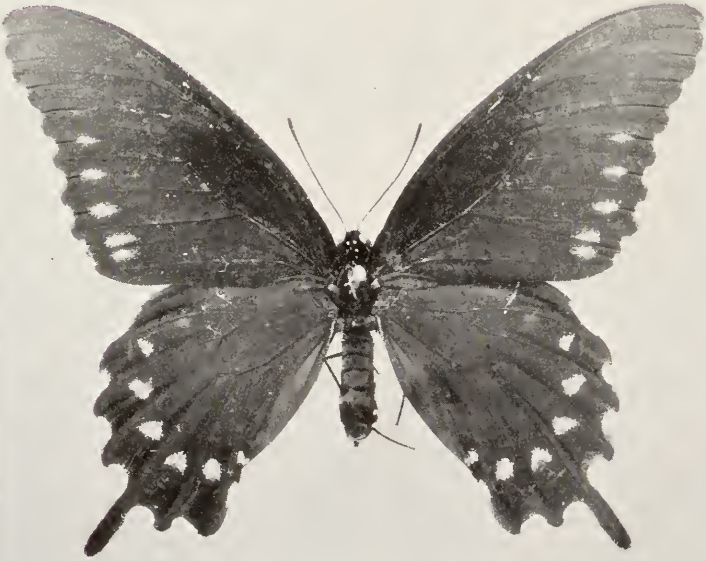

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PAPILIO PHILENOR

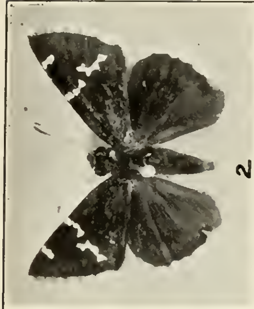
PLATE 30

Papilio philenor philenor

FIGURE 1. Male, Cabin John, Md., September 19, 1925.
2. Female, Cabin John, Md., September 19, 1925.

Plate 31

Figure 1. *Papilio cresphontes*, male, Kentucky, July 27, 1901.
2. *Thorybes daunus*, male, Silver Spring, Md., July 3, 1928.
3. *Thorybes daunus*, female, Cabin John, Md., August 28, 1926.
4. *Thorybes pylades*, female, Cabin John, Md., June 6, 1928.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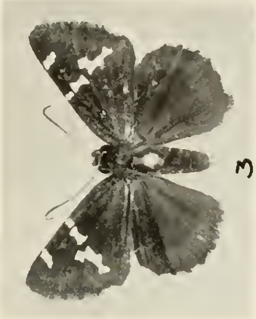
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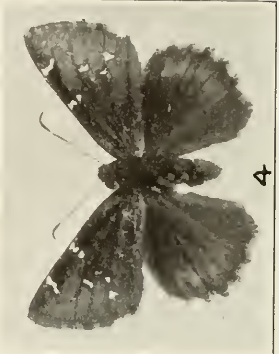
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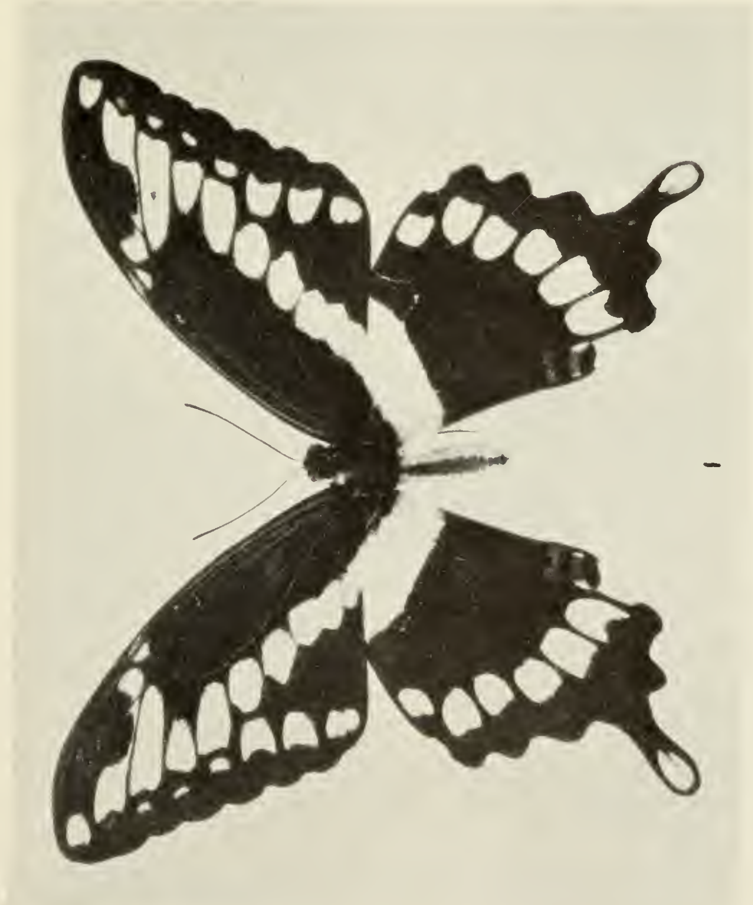
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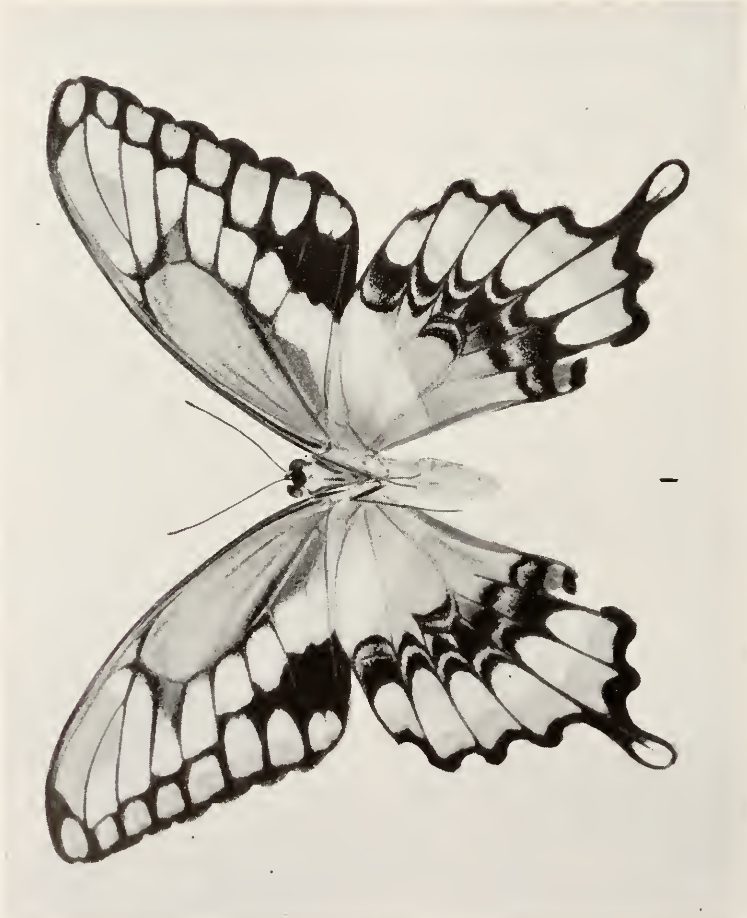
PAPILIO CRESPHONTES, THORYBES DAUNUS, AND T. PYLADES



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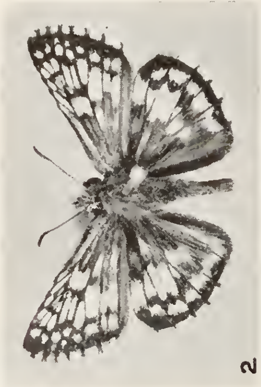

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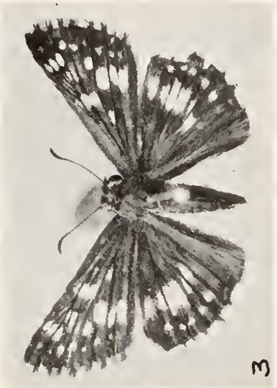

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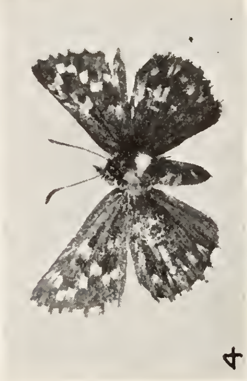

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PAPILIO CRESPHONTES, PYRGUS TESSELLATUS, AND P. CENTAUREAE

PLATE 32

FIGURE 1. *Papilio cresphontes*, male, underside, Kentucky, July 27, 1901.

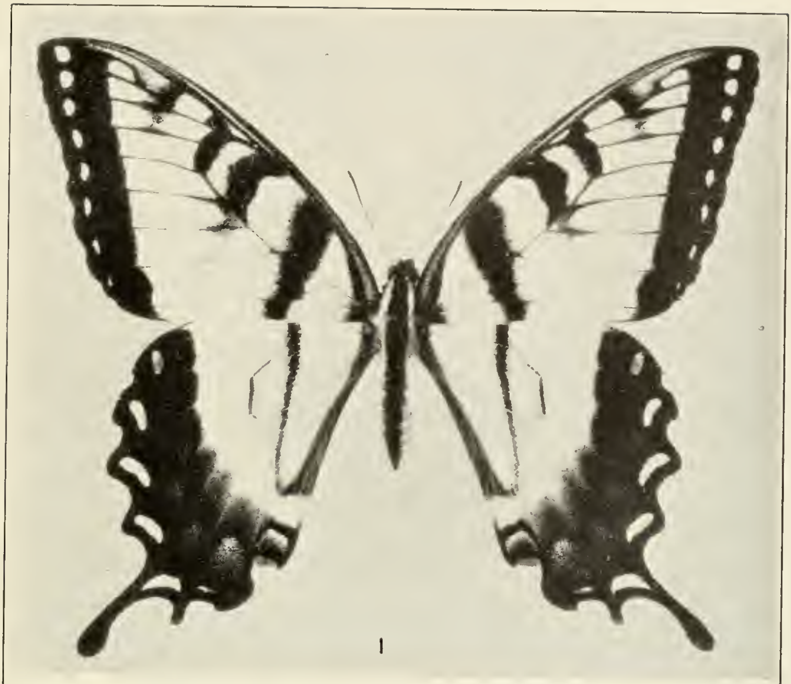
2. *Pyrgus tessellatus*, male, Silver Spring, Md., September 17, 1927. × 1½.

3. *Pyrgus tessellatus*, female, Cabin John, Md., October 3, 1925. × 1½.

4. *Pyrgus centaureae wyandot*, Cabin John, Md., April 19, 1926. × 1½.

PLATE 33

FIGURES 1, 2. *Papilio glaucus glaucus*, male, upper (1) and under (2) sides. Cabin John, Md., August 22, 1926.



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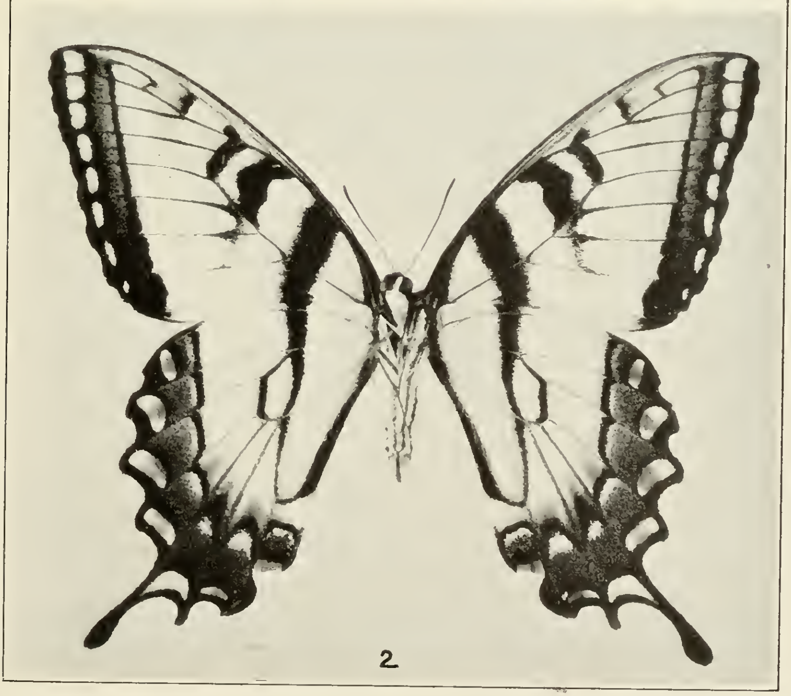

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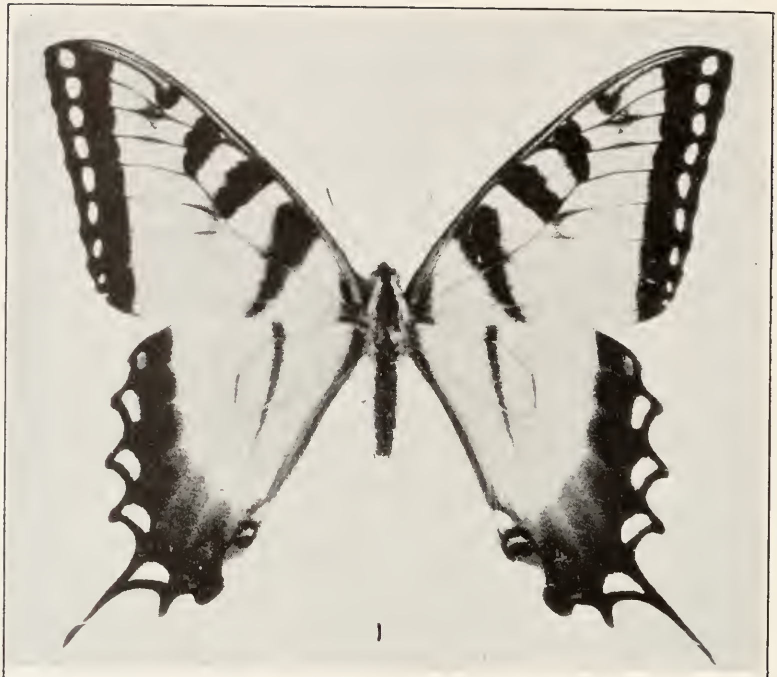
Papilio glaucus



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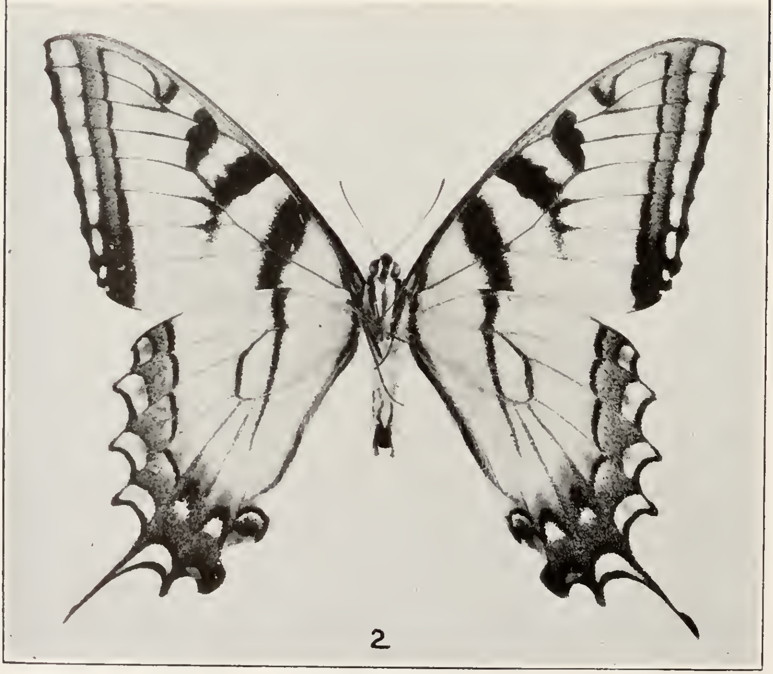


2

Papilio glaucus

PLATE 34

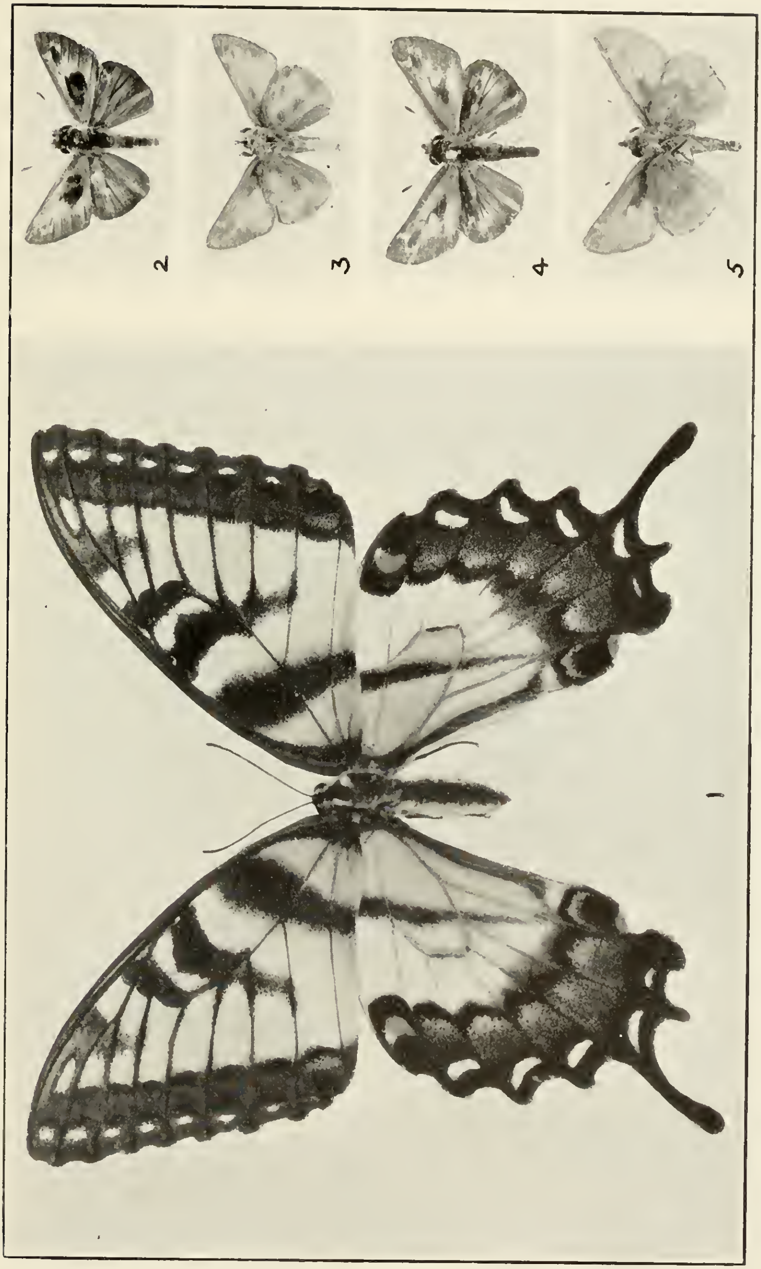
FIGURES 1, 2. *Papilio glaucus*, male, upper (1) and under (2) sides. Essex, Mass., July 13, 1925.

PLATE 35

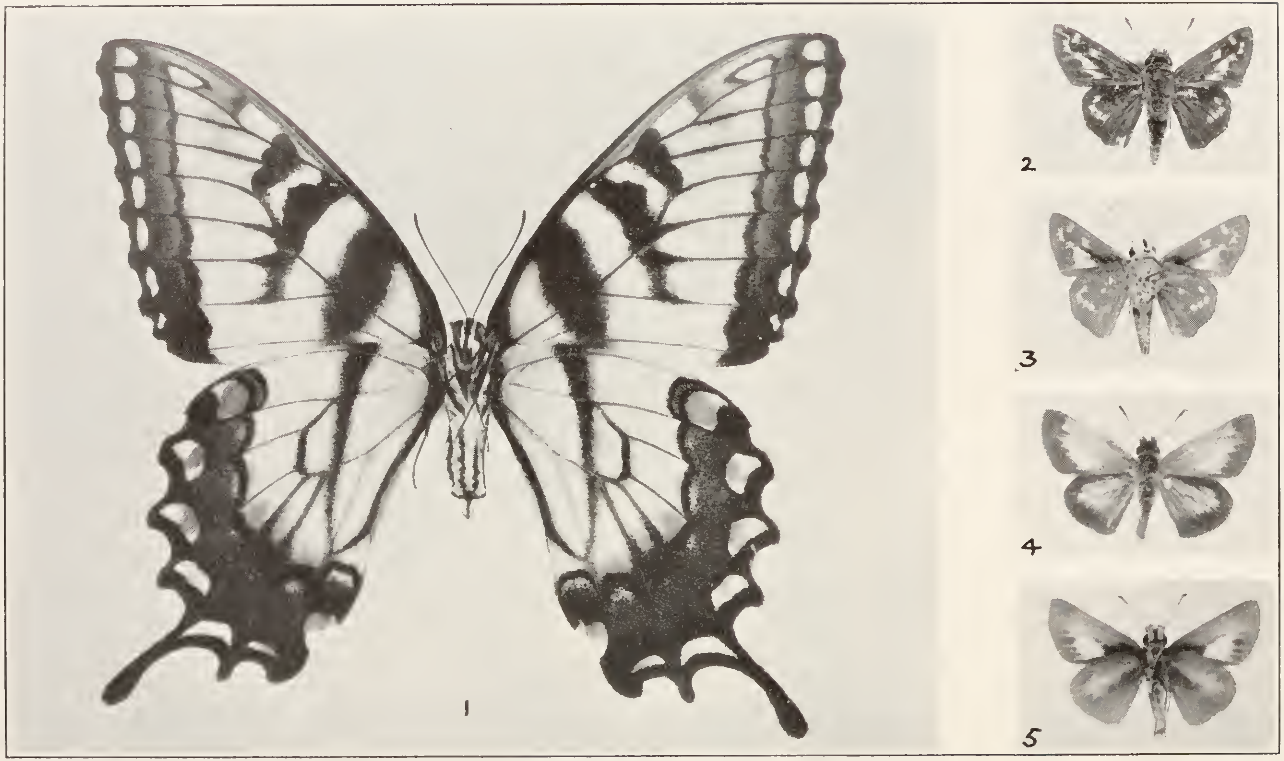
FIGURE 1. *Papilio glaucus glaucus*, female, Silver Spring, Md., August 13, 1927.

2, 3. *Atalopedes campestris*, male, upper (2) and under (3) sides. Silver Spring, Md., August 13, 1927. See Plate 16, Figure 3.

4, 5. *Atalopedes campestris*, female, upper (4) and under (5) sides. Silver Spring, Md., July 28, 1928. See Plate 16, Figure 3.



PAPILIO GLAUCUS AND ATALOPEDES CAMPESTRIS



PAPILIO GLAUCUS, ERYNNIS ATTALUS, AND POANES AARONI

PLATE 36

FIGURE 1. *Papilio glaucus glaucus*, female, underside, Silver Spring, Md., August 13, 1927.

2, 3. *Erynnis attalus*, male, upper (2) and under (3) sides. St. Petersburg, Fla., April 24, 1914.

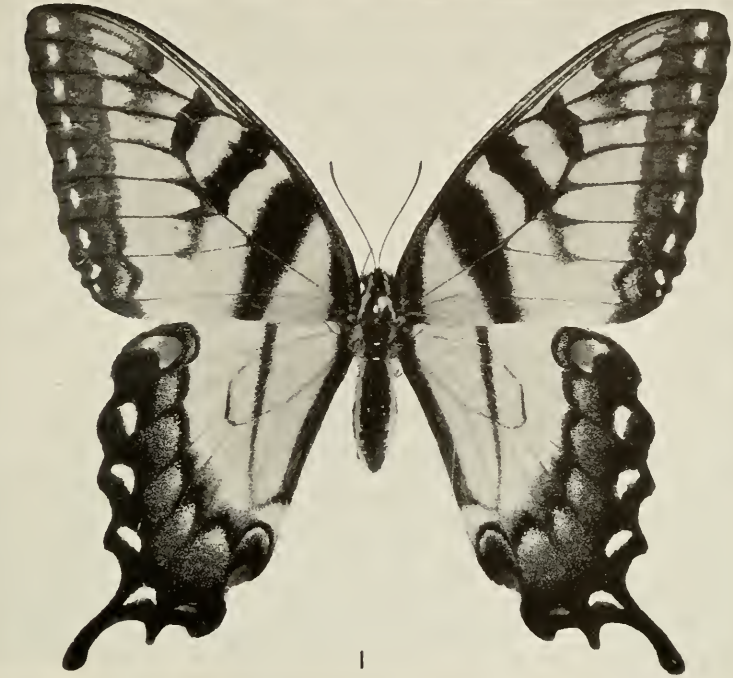
4, 5. *Poanes aaroni aaroni*, male, upper (4) and under (5) sides. New Jersey.

PLATE 37

Females of *Papilio glaucus glaucus*

FIGURE 1. Cream-white form with slightly scalloped hind wings. Silver Spring, Md., September 8, 1926.

2. Ochreous form with deeply scalloped hind wings. Silver Spring, Md., July 17, 1927.



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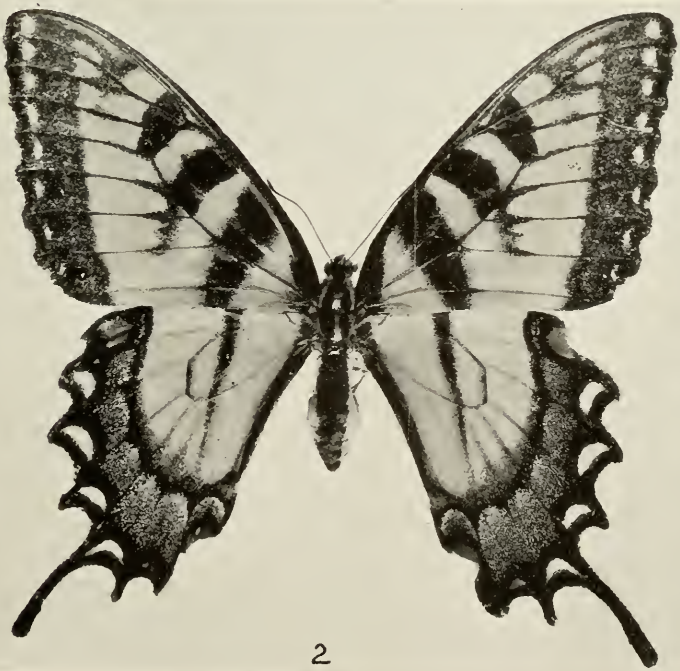

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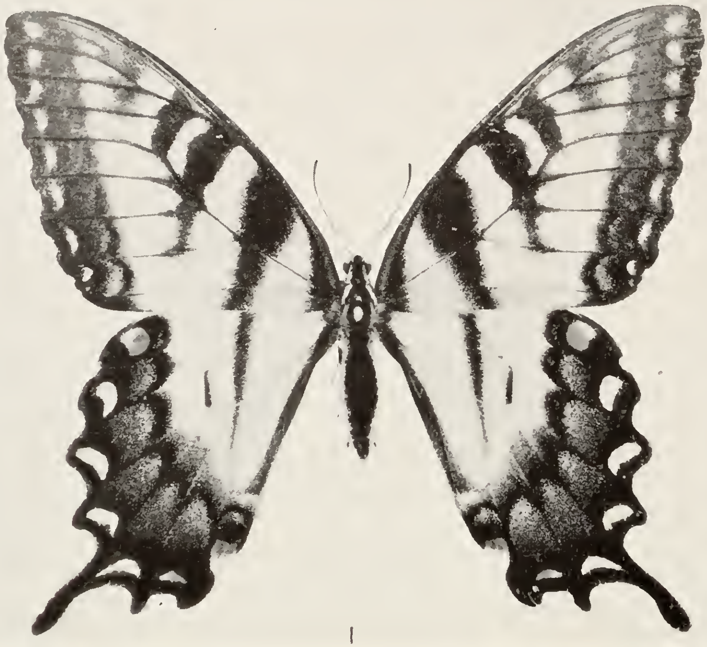
PAPILIO GLAUCUS



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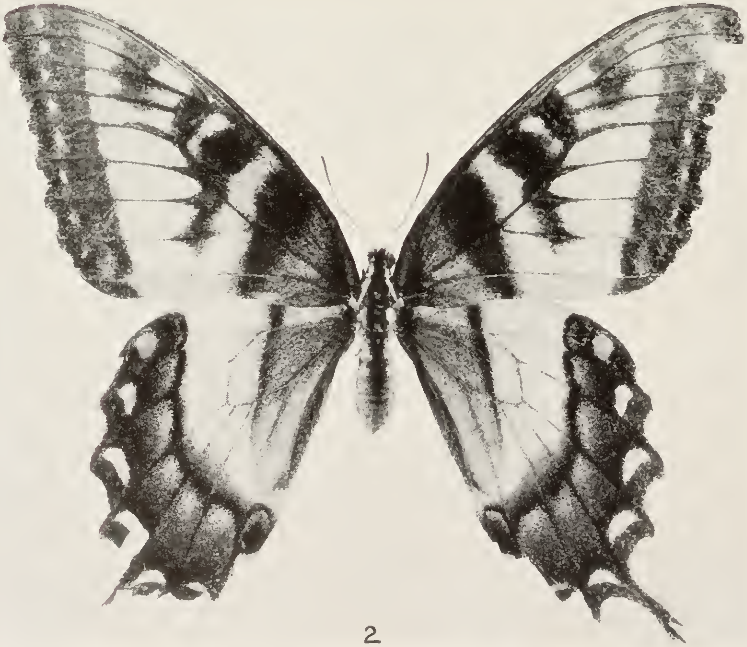

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Papilio glaucus

PLATE 38

Females of *Papilio glaucus glaucus*

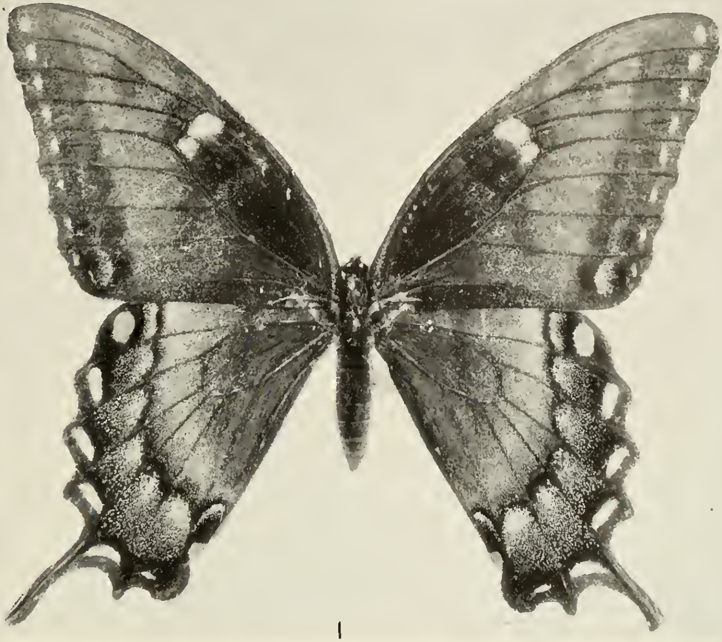
FIGURE 1. Cream-white form with the hind wings heavily speckled with blue and the second and third black bands on the fore wings close together. Silver Spring, Md., August 6, 1927.

2. Cream-white form with the inner portion of the wings speckled with dark scales. Silver Spring, Md., August 3, 1927.

PLATE 39

Female of *Papilio glaucus glaucus*

FIGURES 1, 2. Dark form with the outer portion of the wings speckled with yellow scales, upper (1) and under (2) sides. Washington, D. C., William Schaus.



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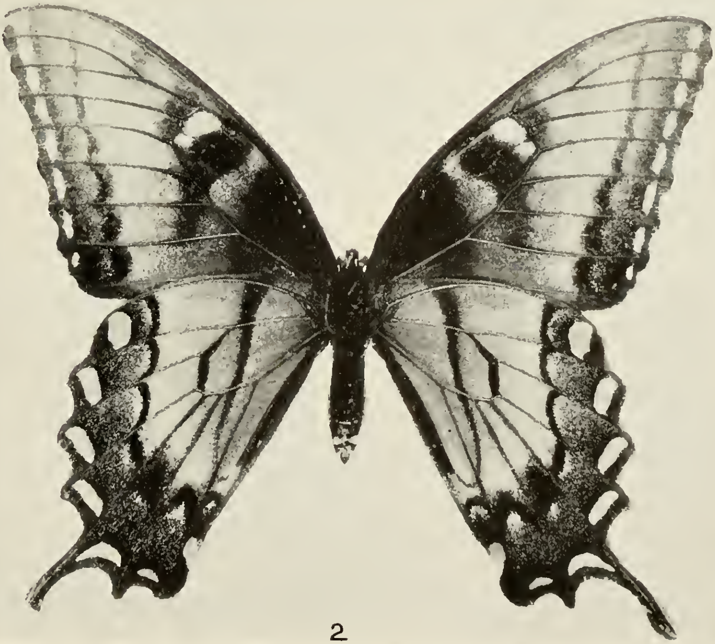

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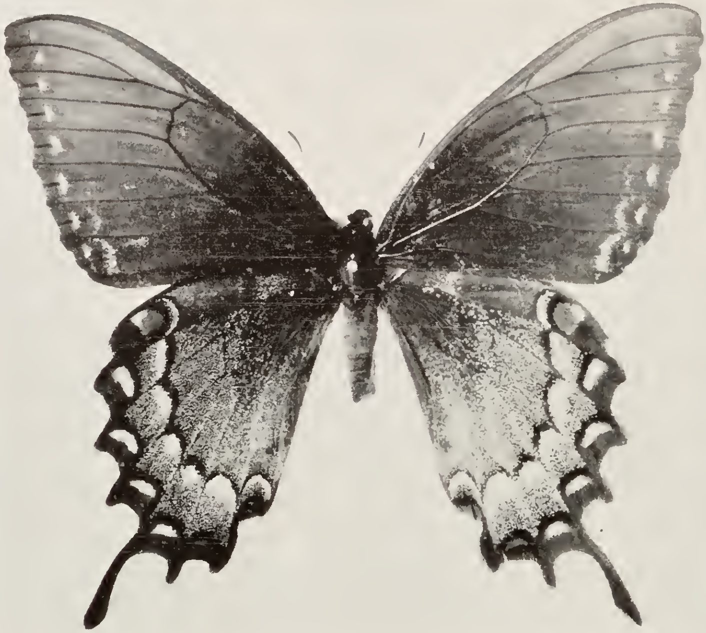
Papilio glaucus



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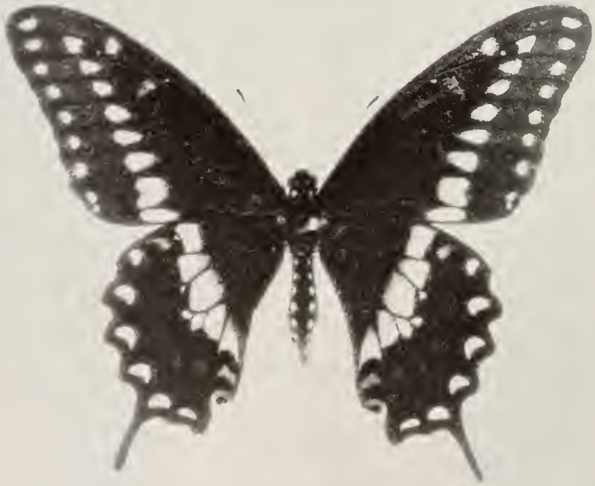

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Papilio glaucus and P. polyxenes

PLATE 40

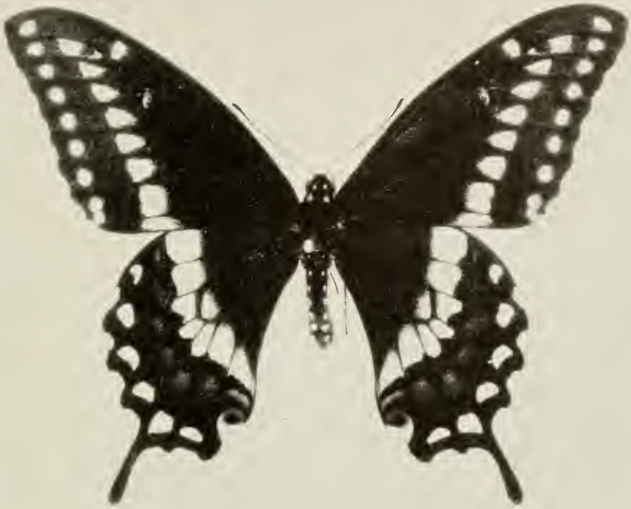
FIGURE 1. *Papilio glaucus glaucus*, dark female.

2. *Papilio polyxenes asterias*, male, with the yellow band displaced basally. Silver Spring, Md., August 1, 1927.

PLATE 41

Papilio polyxenes asterias

FIGURE 1. Typical male, Silver Spring, Md., July 24, 1927.
2. Typical female, Silver Spring, Md., July 21, 1927. Underside of same specimen shown on Plate 44, Figure 1.



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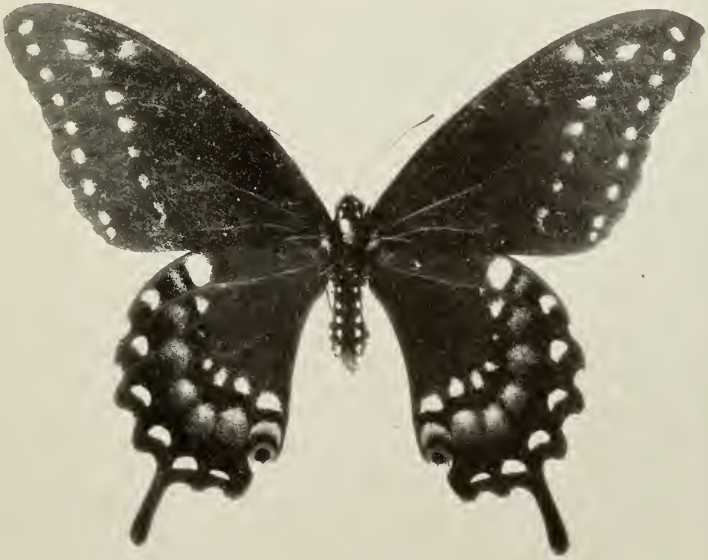

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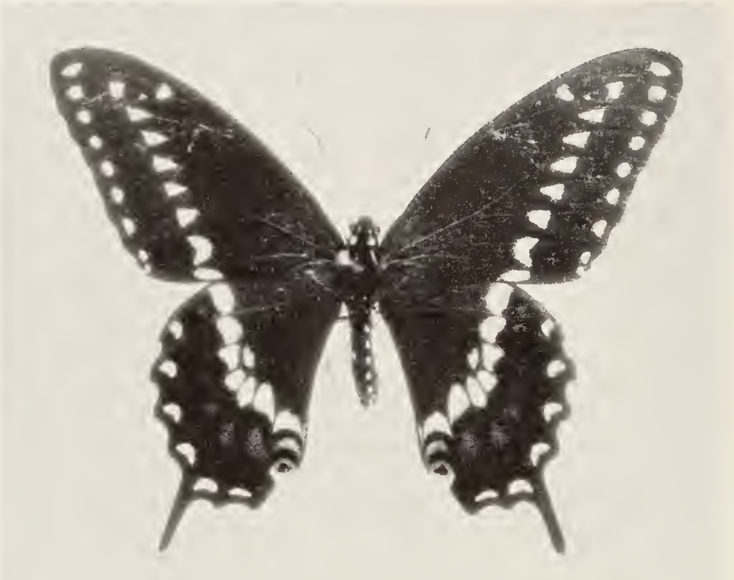
Papilio polyxenes



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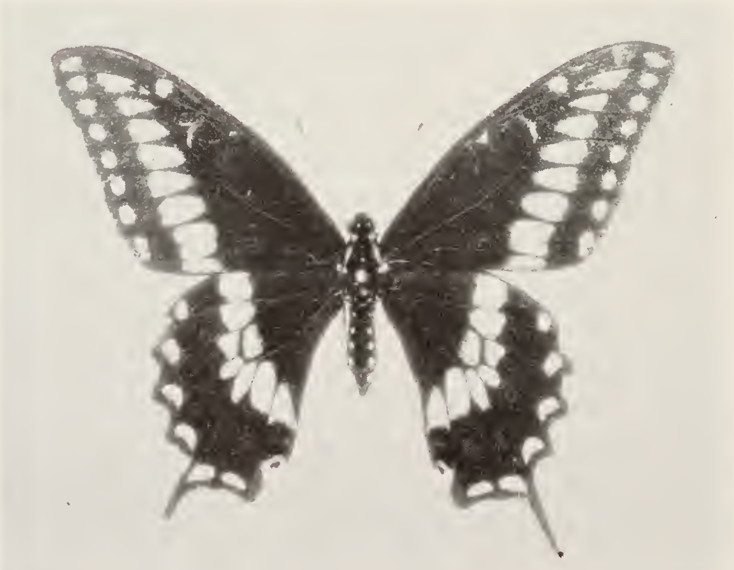

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Papilio polyxenes

PLATE 42

Papilio polyxenes asterias

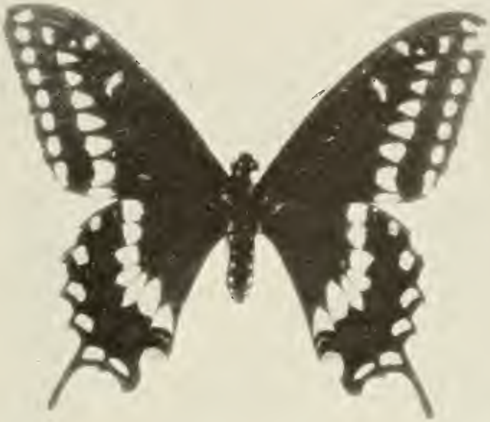
FIGURE 1. Male with narrow yellow band, Silver Spring, Md., July 24, 1927.
2. Male with broad yellow band on fore wings, Silver Spring, Md., August 14, 1927.

PLATE 43

Papilio polyxenes asterias

FIGURE 1. Male with ochreous markings, no yellow in cell of hind wing, and no black center in orange spot at anal angle. Silver Spring, Md., July 3, 1928.

2. Male with no yellow in cell of hind wing. Silver Spring, Md., May 20, 1928.



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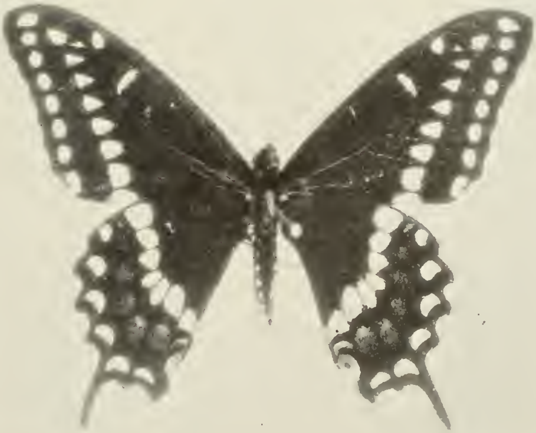

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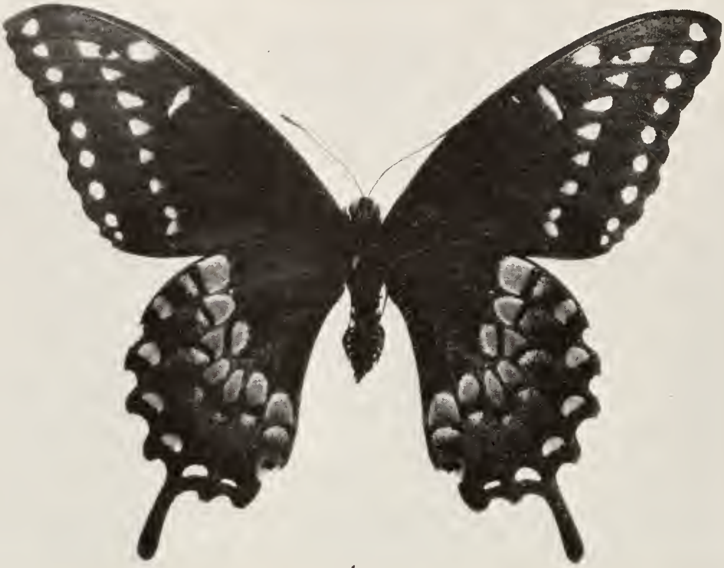
PAPILIO POLYXENES



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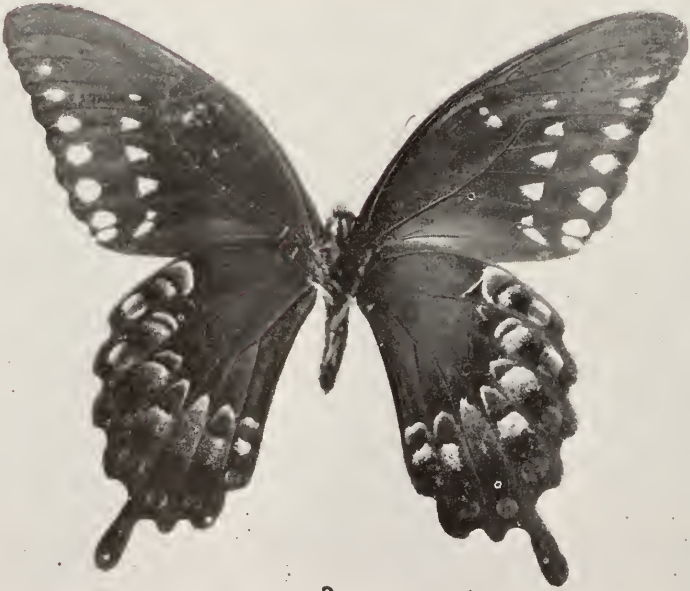

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PAPILIO POLYXENES AND P. TROILUS

PLATE 44

FIGURE 1. *Papilio polyxenes asterias*, female, underside. Silver Spring, Md., July 21, 1927. Upper side of same specimen shown on Plate 41, Figure 2.

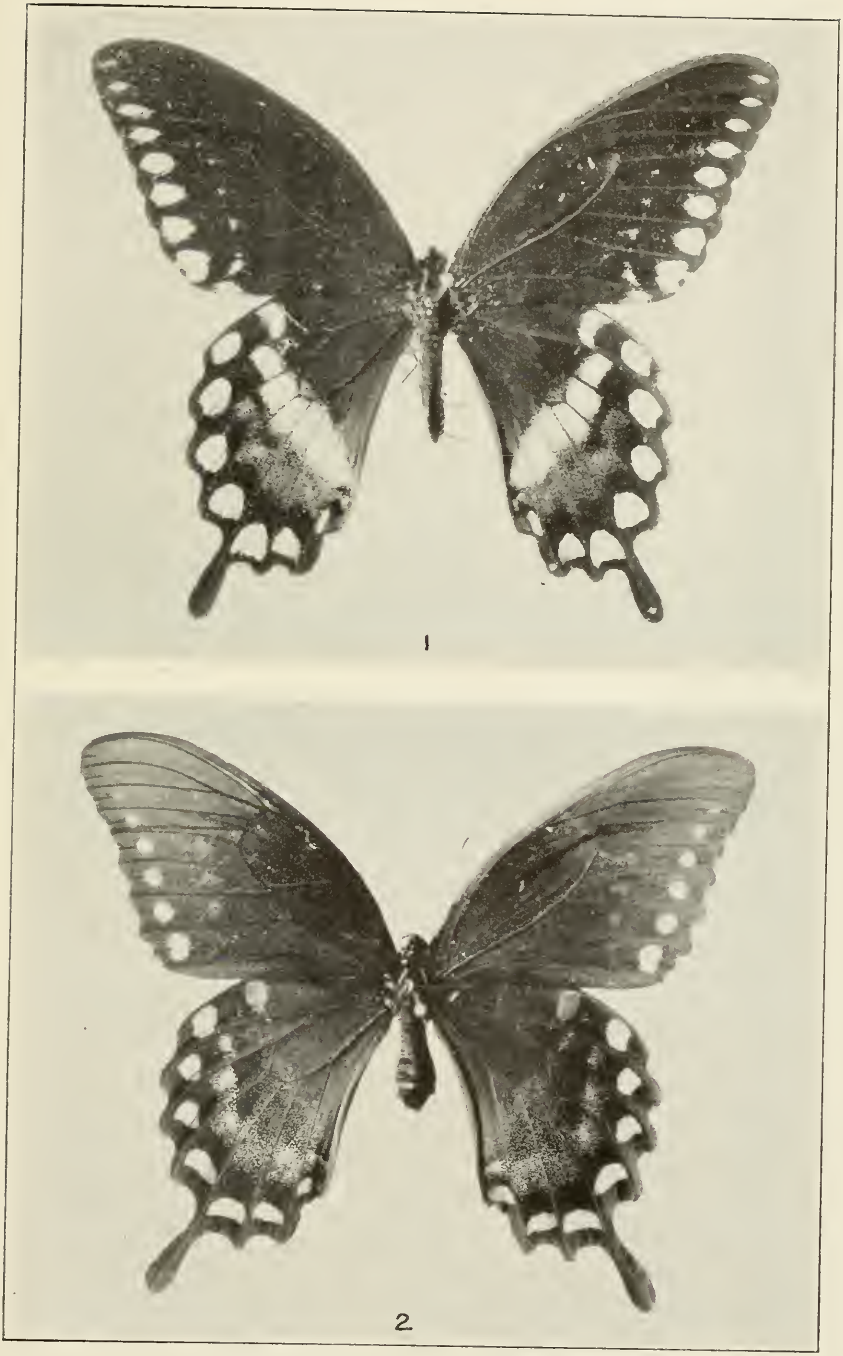
2. *Papilio troilus troilus*, male, underside, Cabin John, Md., August 27, 1926. Upper side of same specimen shown on Plate 45, Figure 1.

PLATE 45

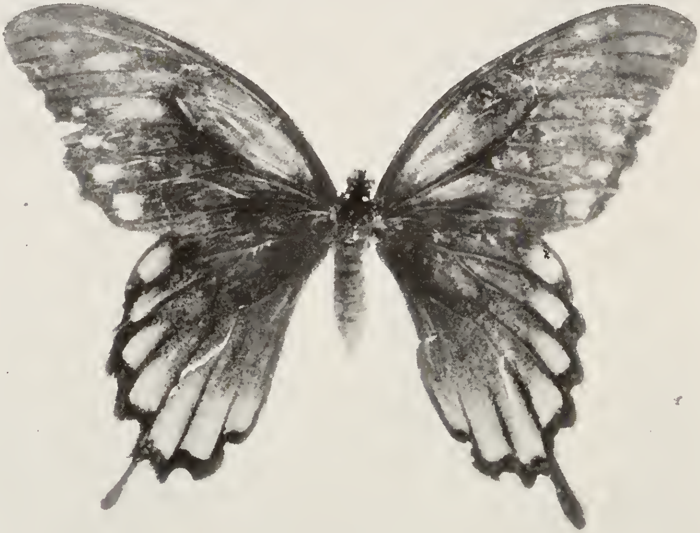
Papilio troilus troilus

FIGURE 1. Male, Cabin John, Md., August 27, 1926. Underside of same specimen shown on Plate 44, Figure 2.

2. Female, Silver Spring, Md., August 6, 1927.



Papilio troilus, Male and Female



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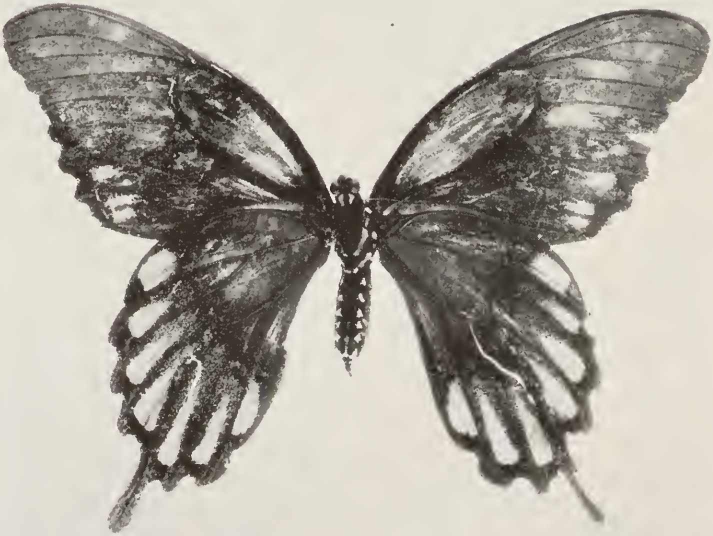

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Papilio troilus ab. radiatus

PLATE 46

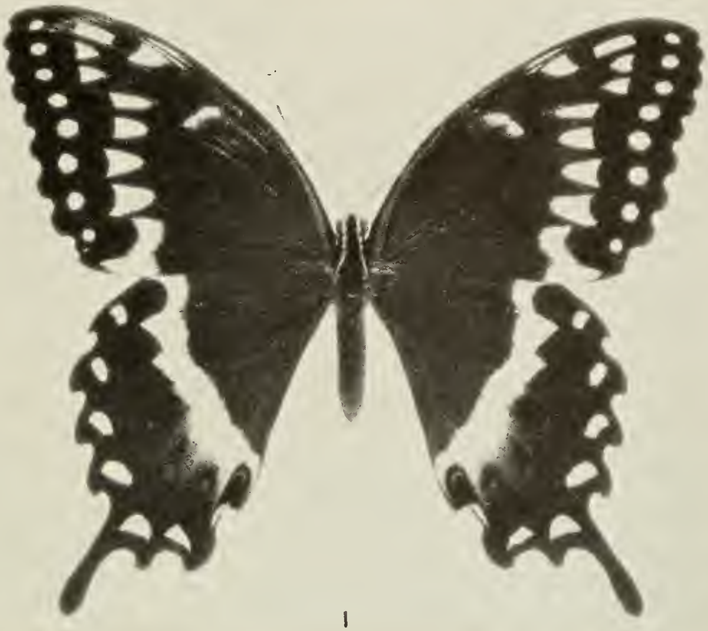
Papilio troilus ab. *radiatus*

FIGURES 1, 2. Upper (1) and under (2) sides of a female, from Washington, D. C., collected by D. B. Mackey, November 10, 1907.

Plate 47

Papilio palamedes

Figures 1–2. Male, upper (1) and under (2) sides, from Virginia Beach, Va., collected by William Schaus.



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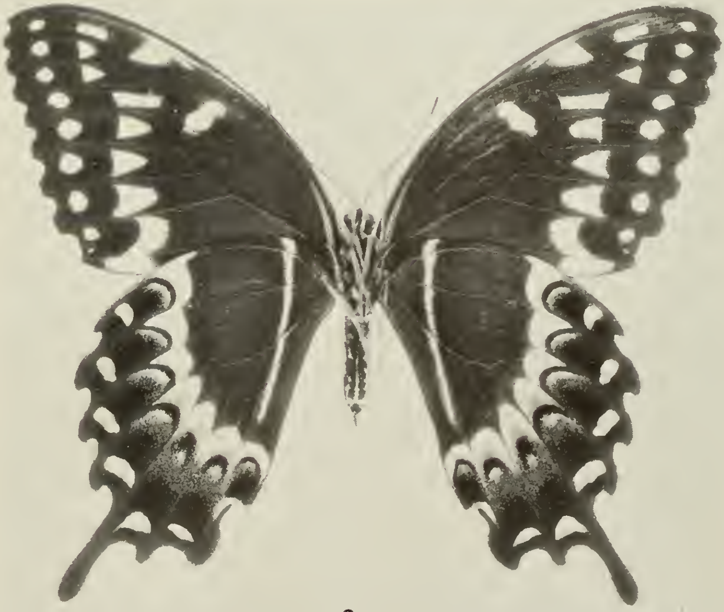

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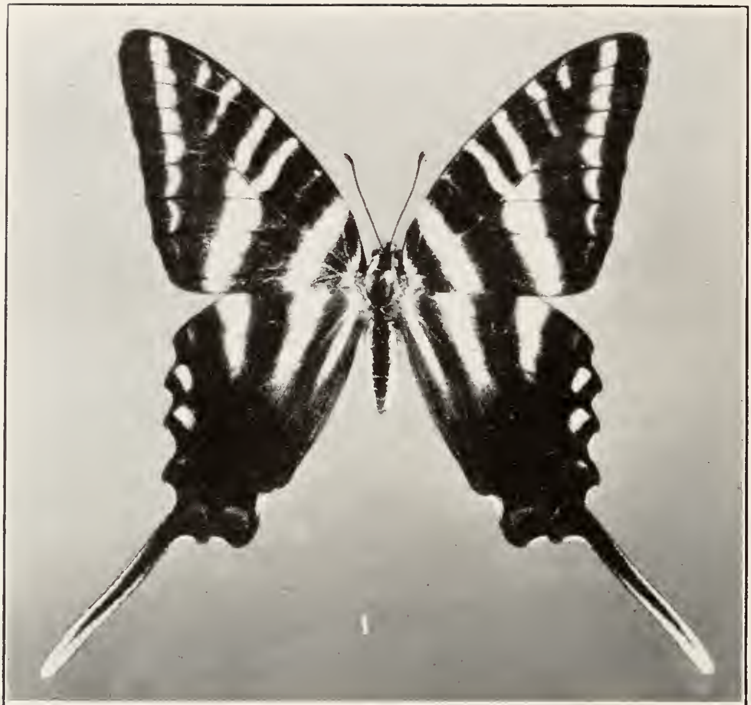
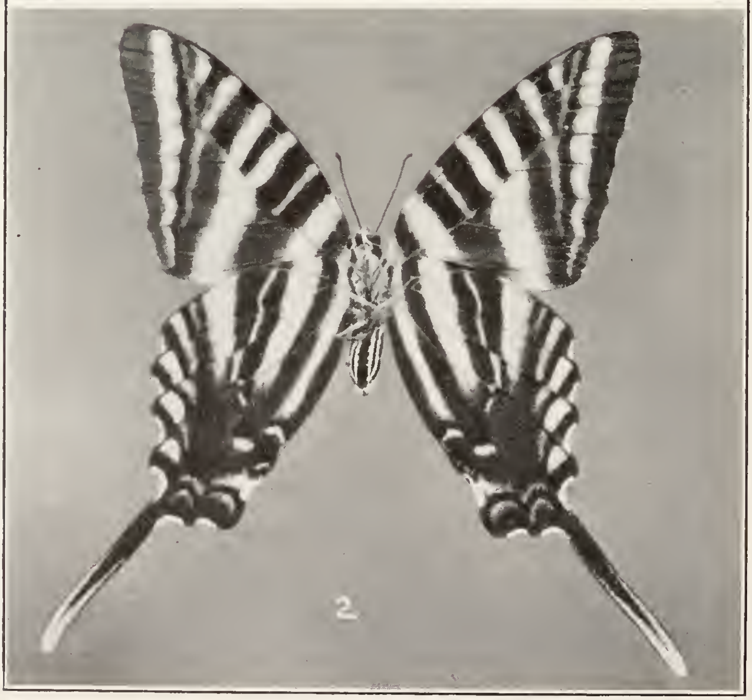
PAPILIO PALAMEDES





PAPILIO MARCELLUS

PLATE 48

Papilio marcellus

FIGURES 1, 2. Female, summer form, upper (1) and under (2) sides, Cabin John, Md., July 29, 1928. H. U. Clark.

PLATE 49

FIGURES 1, 2. *Papilio marcellus*, female, spring form, under (1) and upper (2) sides. Great Falls, Md., May 2, 1926.

3. *Polites manataaqua manataaqua*, male, Washington, D. C., A. Koebele, August 18, 1883.

4. *Polites manatuaqua manataaqua*, female, Cabin John, Md., September 9, 1926.

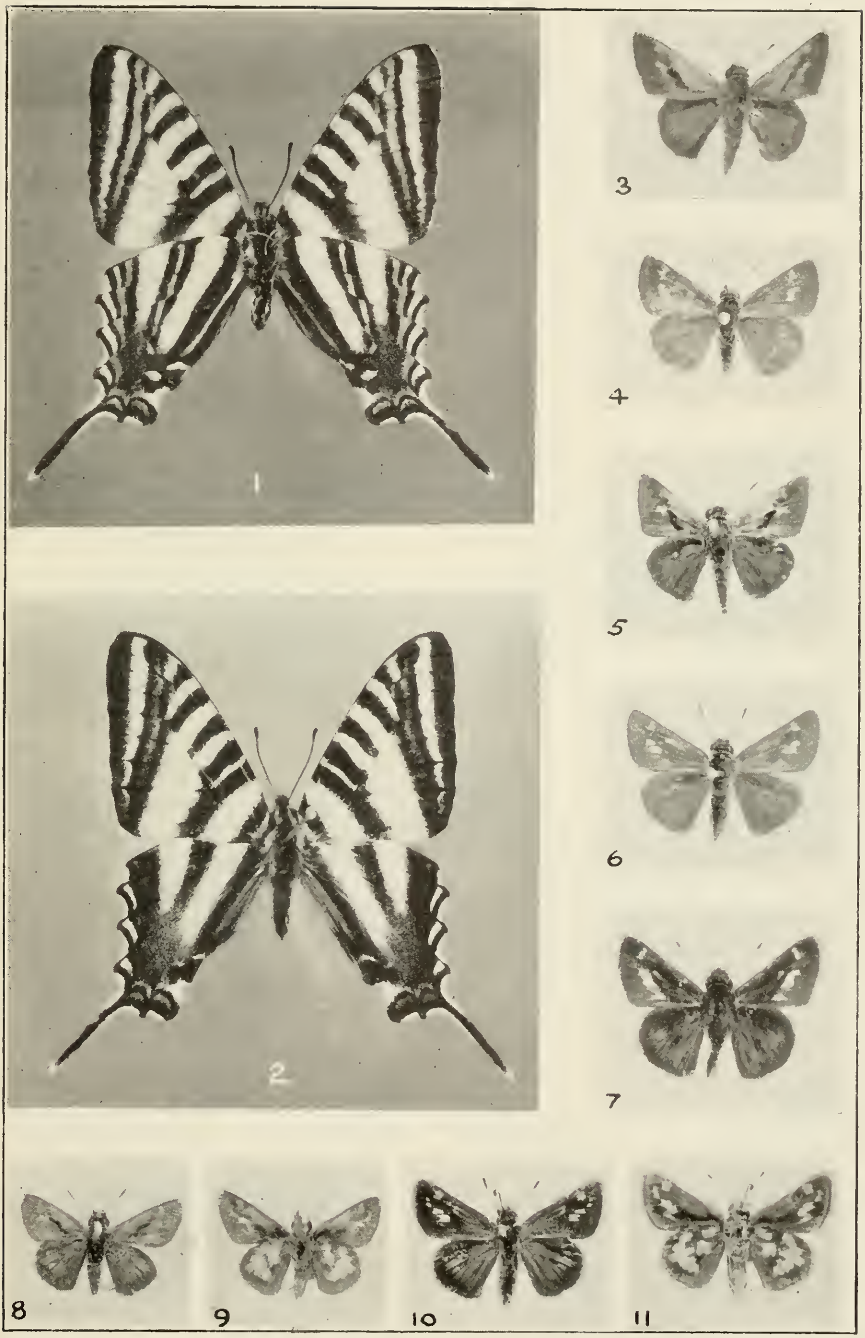
5. *Polites cernes*, male. Silver Spring. Md., June 3. 1928.

6. *Polites cernes*, female, Silver Spring, Md., June 17, 1928.

7. *Polites verna*, male. July 14, 1907.

8, 9. *Polites coras*, male, upper (8) and under (9) sides. Silver Spring, Md., August 15, 1928.

10, 11. *Polites coras*, female, upper (10) and under (11) sides. Cabin John, Md., August 10, 1927.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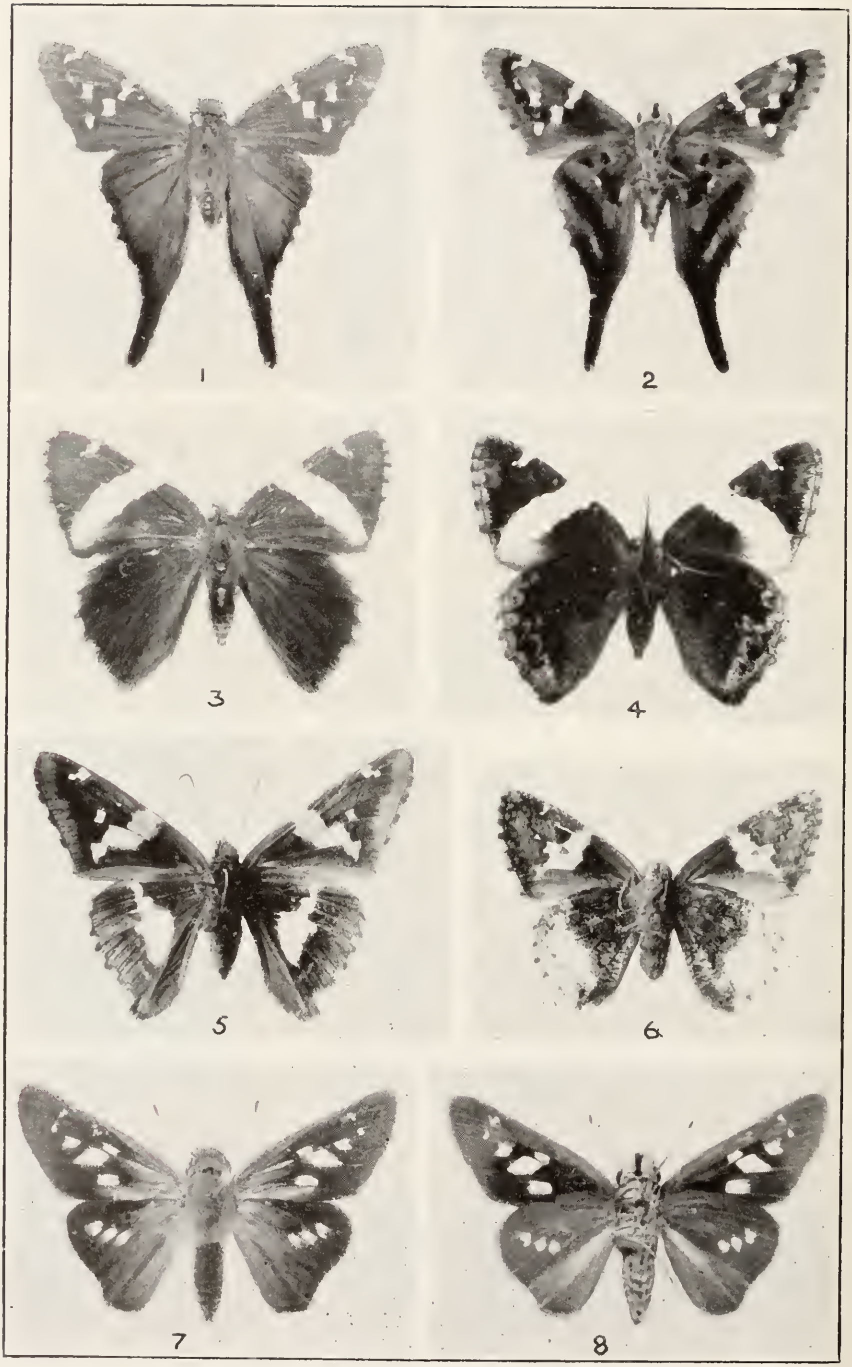
PAPILIO MARCELLUS: POLITES



Goniurus, Cecropterus, Epargyreus, Achalarus, and Calpodes

PLATE 50

FIGURES 1, 2. *Goniurus proteus*, female, upper (1) and under (2) sides. Florida. W. D. Kearfott.

3, 4. *Cecropterus cellus*, upper (3) and under (4) sides.

5. *Epargyreus tityrus*, male, underside. Cabin John, Md., June 1, 1925.

6. *Achalarus lyciades*, female, underside. Cabin John, Md., June 13, 1926.

7, 8. *Calpodes ethlius*, upper (7) and under (8) sides. Brownsville, Tex.

PLATE 51

FIGURES 1, 2. *Thanaos horatius*, male, upper (1) and under (2) sides. Miami, Fla.

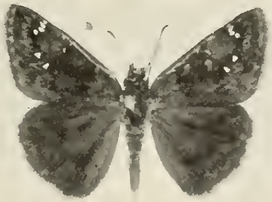
3. *Thanaos horatius*, female.

4, 5. *Thanaos juvenalis*, male, upper (4) and under (5) sides. Cabin John, Md., April 13, 1925.

6, 7. *Thanaos juvenalis*, female, upper (6) and under (7) sides. Silver Spring, Md., August 6, 1927.

8. *Thanaos juvenalis*, male.

9, 10. *Thanaos juvenalis*, female, upper (9) and under (10) sides.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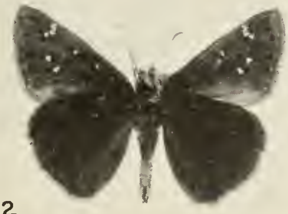
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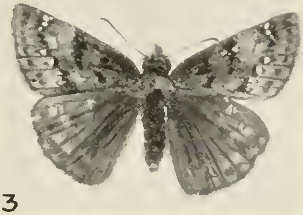
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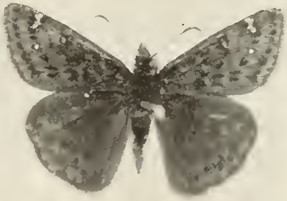
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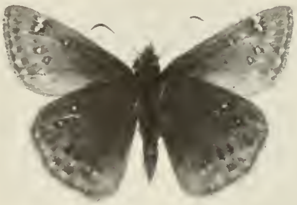
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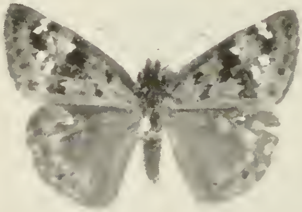
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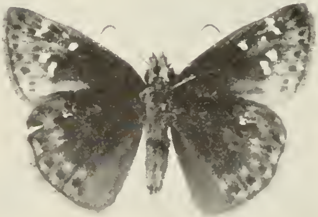
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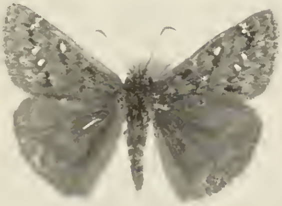
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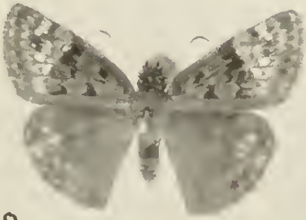
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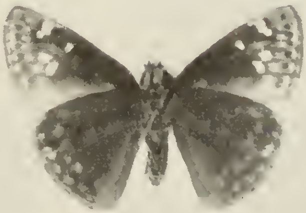
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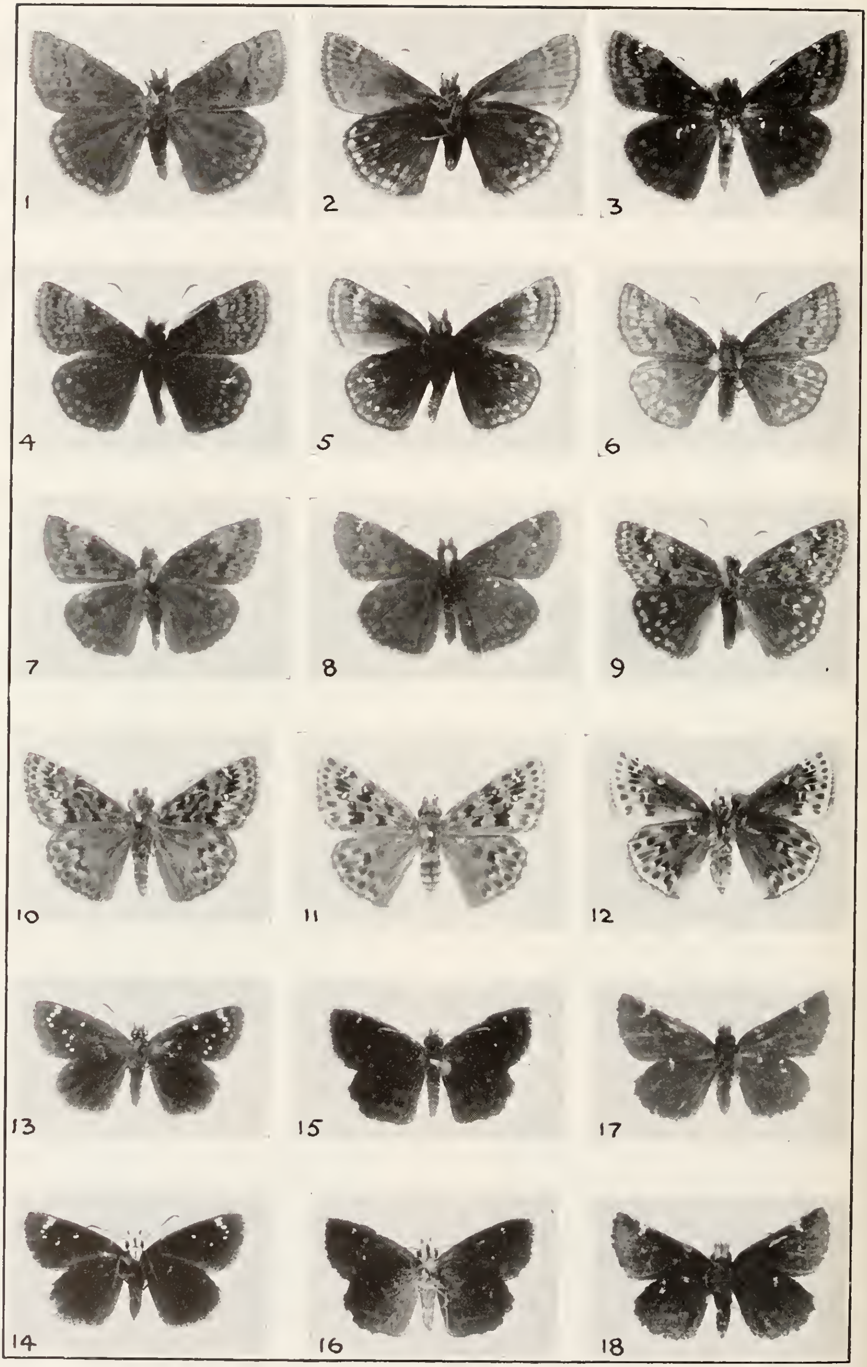
THANAOS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THANAOS, PHOLISORA, AMBLYSCIRTES, AND STAPHYLUS

PLATE 52

FIGURES 1, 2. *Thanaos brizo brizo*, male, upper (1) and under (2) sides. O. Meske. May 19, 1870.

3. *Thanaos terentius*, male.

4, 5. *Thanaos icelus*, male, upper (4) and under (5) sides. Cabin John, Md., May 25, 1930.

6. *Thanaos icelus*, female, Cabin John, Md., May 25, 1930.

7. *Thanaos lucilius*, male.

8. *Thanaos persius*, male.

9. *Thanaos persius*, female.

10. *Thanaos martialis*, male, June 3, 1876.

11, 12. *Thanaos martialis*, female, upper (11) and under (12) sides, June 3, 1876.

13, 14. *Pholisora catullus*, female, upper (13) and under (14) sides. Onaga, Kans.

15, 16. *Staphylus hayhurstii*, male, upper (15) and under (16) sides. Texas.

17, 18. *Amblyscirtes vialis*, upper (17) and under (18) sides. Wellington, British Columbia, June 27, 1903. G. W. Taylor.

PLATE 53

FIGURES 1, 2. *Poanes massasoit massasoit*, male, upper (1) and under (2) sides. Weston, Mass., July 9, 1923.

3, 4. *Poanes massasoit hughi*, male, upper (3) and under (4) sides. Beltsville, Md., July 15, 1928.

5, 6. *Poanes massasoit massasoit*, female, upper (5) and under (6) sides. Weston, Mass., July 9, 1923.

7, 8. *Poanes massasoit hughi*, female, upper (7) and under (8) sides. Beltsville, Md., July 15, 1928.

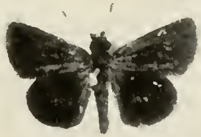
9, 10. *Poanes massasoit massasoit*, dark female, upper (9) and under (10) sides. New Jersey.

11, 12. *Poanes massasoit* form *suffusa*, female, upper (11) and (12) under sides. New Jersey.

13, 14. *Hylephila phylaeus*, male, upper (13) and under (14) sides. Cabin John, Md., August 29, 1929.

15, 16. *Polites vibex brettus*, male, upper (15) and under (16) sides. St. Petersburg, Fla., April 20, 1916.

17, 18. *Lerema accius*, male, upper (17) and under (18) sides. Indian River, Fla.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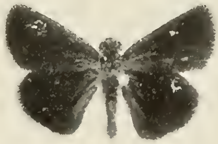
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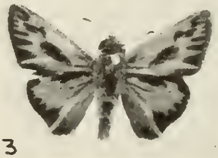
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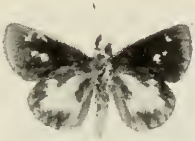
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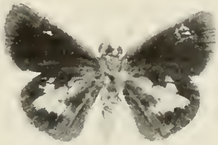
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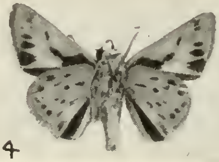
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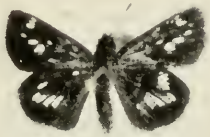
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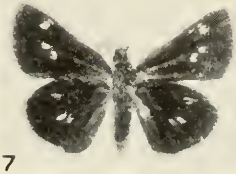
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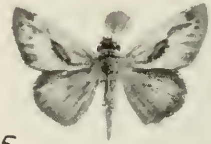
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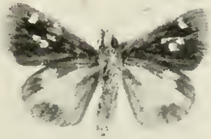
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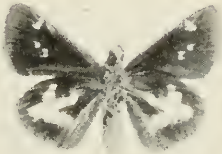
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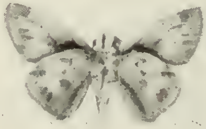
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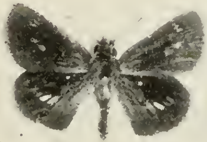
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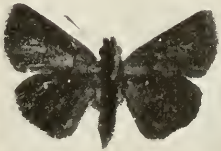
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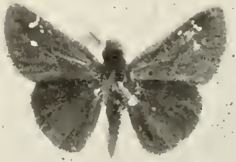
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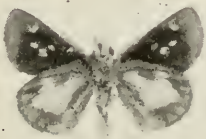
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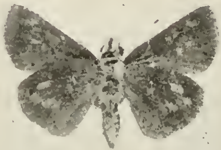
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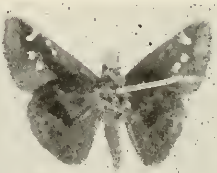
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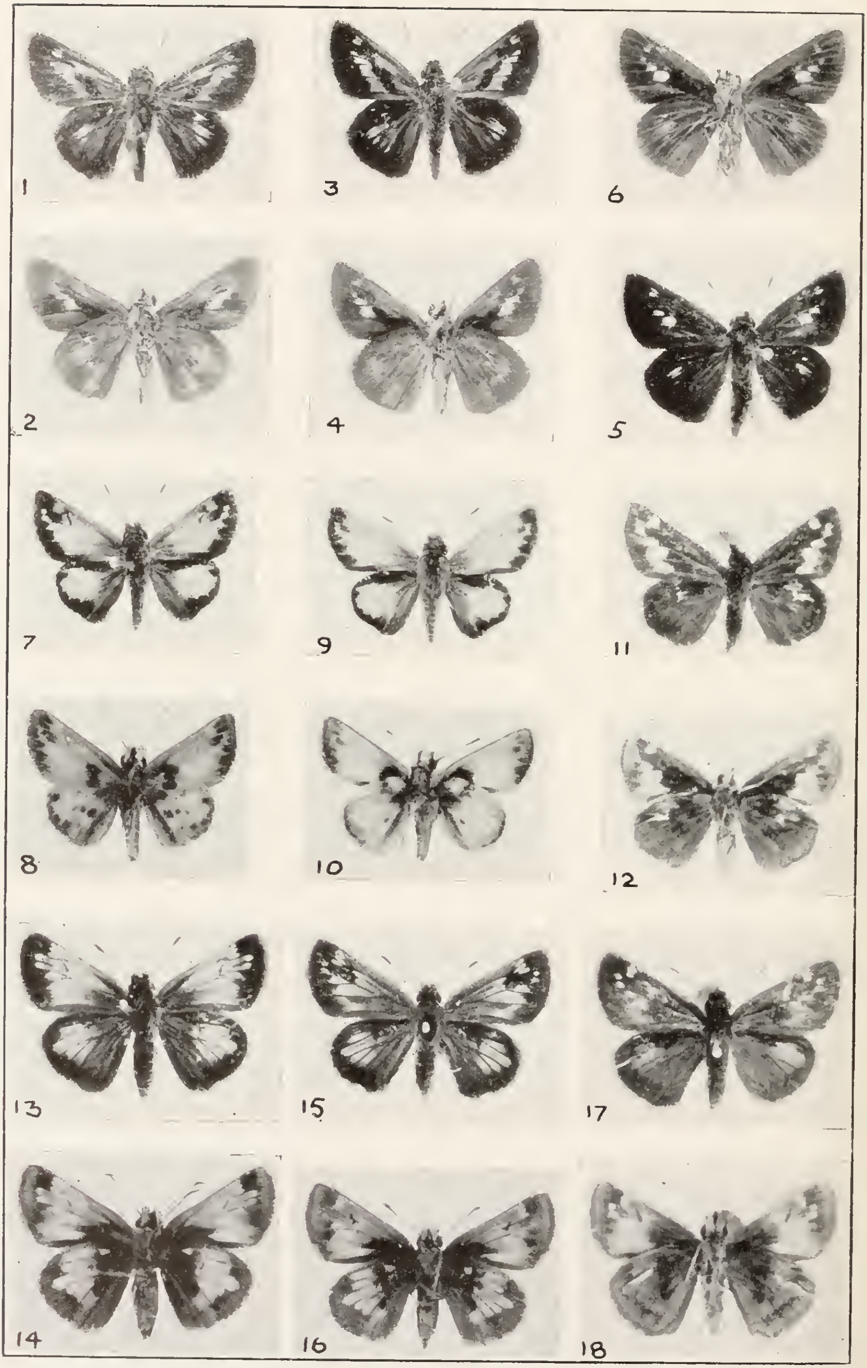
POANES, HYLEPHILA, POLITES, AND LEREMA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ATRYTONE PONTIAC, POANES ZABULON, AND P. HOBOMOK

PLATE 54

FIGURES 1, 2. *Atrytone pontiae*, male, upper (1) and under (2) sides. Newtonville, Mass., July 11, 1923.

3, 4. *Atrytone pontiae*, male, upper (3) and under (4) sides. Beltsville, Md., July 15, 1928.

5, 6. *Atrytone pontiae*, female, upper (5) and under (6) sides. Beltsville, Md., July 6, 1929.

7, 8. *Poanes zabulon*, male, upper (7) and under (8) sides. Cabin John, Md., September 1, 1929.

9, 10. *Poanes zabulon*, male, upper (9) and under (10) sides. High Island, Md. R. P. Currie.

11, 12. *Poanes zabulon*, female, upper (11) and under (12) sides. Cabin John, Md., June 2, 1929.

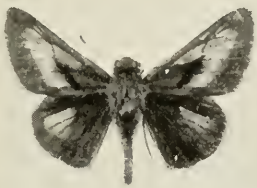
13, 14. *Poanes hobomok*, female, upper (13) and under (14) sides. Cabin John Md., June 2, 1929.

15, 16. *Poanes hobomok*, female, upper (15) and under (16) sides. New Jersey.

17, 18 *Poanes hobomok*, female, upper (17) and under (18) sides. Cabin John, Md., June 2, 1929.

PLATE 55

FIGURES 1, 2. *Atrytone dion*, male, upper (1) and under (2) sides.
3, 4. *Erynnis metea*, male, upper (3) and under (4) sides.
5, 6. *Atrytone bimacula*, male, upper (5) and under (6) sides. O. Meske, June 15, 1870.
7, 8. *Polites mystic*, male, upper (7) and under (8) sides.
9, 10. *Atrytonopsis loammi*, male, upper (9) and under (10) sides. Miami, Fla.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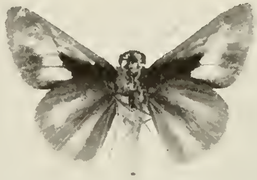
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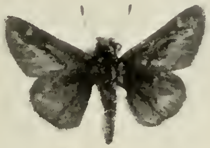
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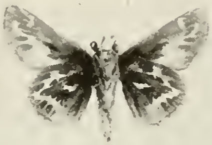
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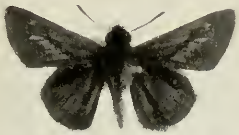
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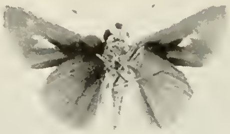
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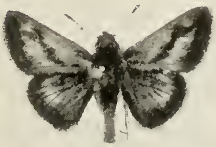
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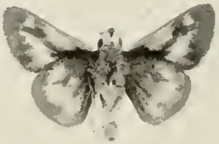
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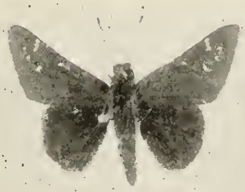
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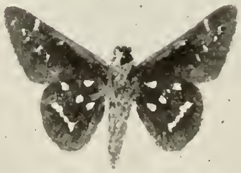
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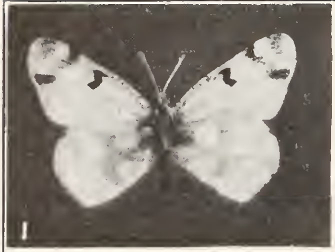
ATRYTONE, ERYNNIS, POLITES, AND ATRYTONOPSIS



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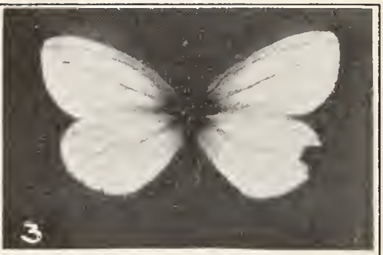

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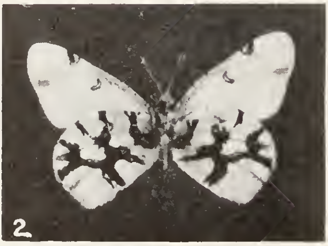

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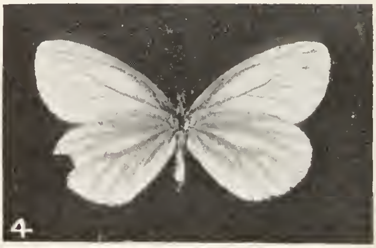

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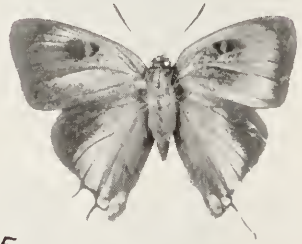

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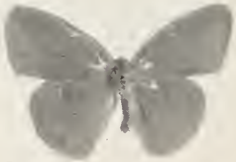

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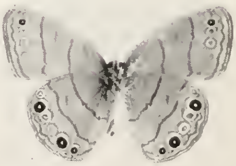

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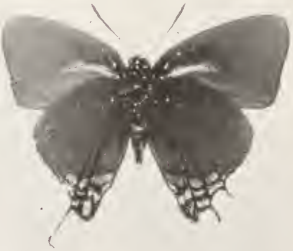

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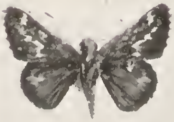

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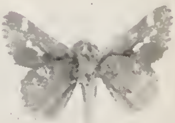

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ANTHOCHARIS, PIERIS, ATLIDES, NEONYMPHA, AND AMBLYSCIRTES

PLATE 56

FIGURES 1, 2. *Anthocharis olympia*, upper (1) and under (2) sides. Texas.
3, 4. *Pieris virginiensis*, upper (3) and under (4) sides. Ithaca, N. Y., May 25, 1926.
5, 6. *Atlides halesus*, male, upper (5) and under (6) sides. Florida.
7, 8. *Neonympha sosybius*, male, upper (7) and under (8) sides. Florida.
9, 10. *Amblyscirtes samoset*, upper (9) and under (10) sides.

PLATE 57

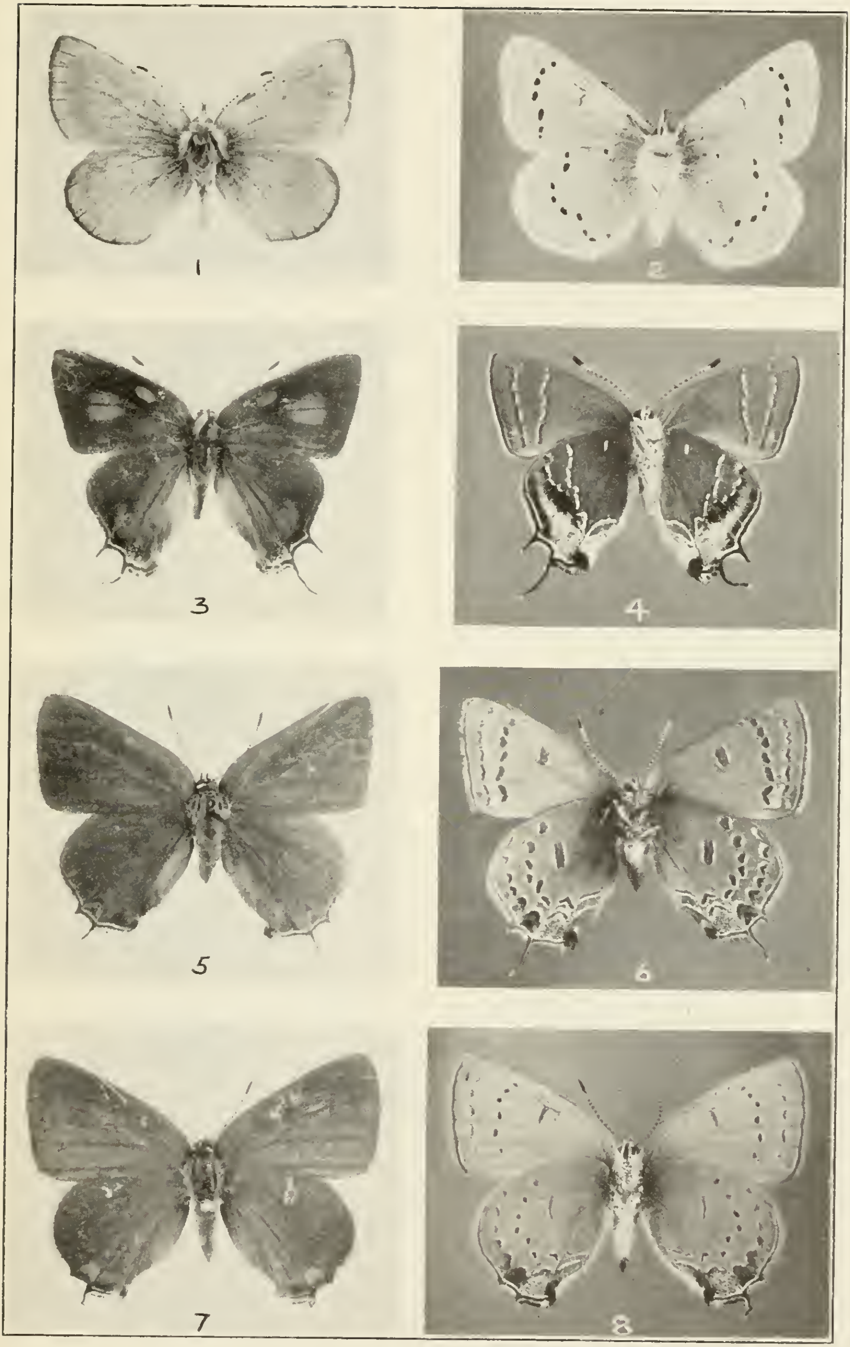
(All figures × 1½)

FIGURES 1, 2. *Glaucopsyche lygdamus*, upper (1) and under (2) sides. Wellington, British Columbia. G. W. Taylor, May 5, 1903.

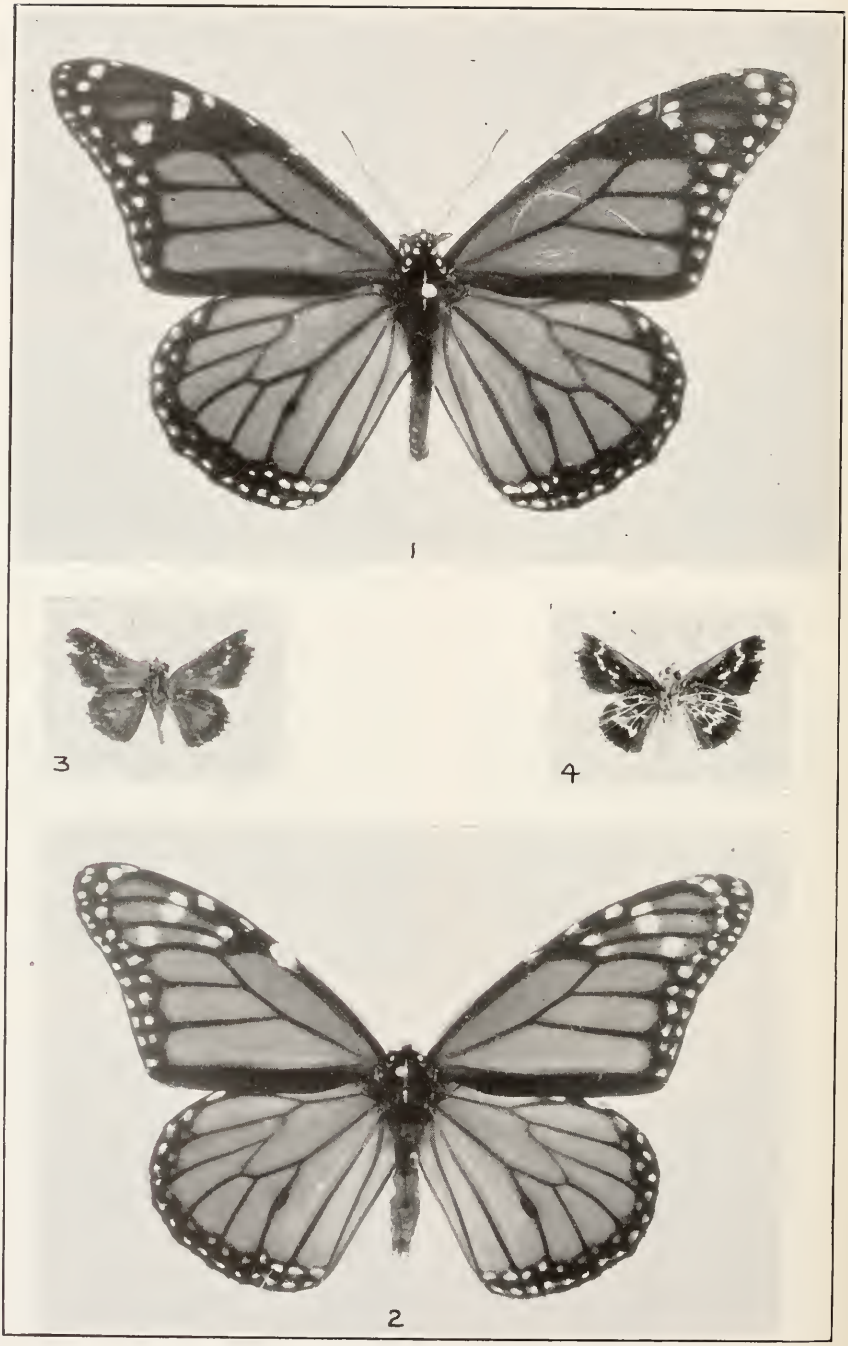
3, 4. *Strymon favonius*, male, upper (3) and under (4) sides. E. T. Owen.

5, 6. *Strymon edwardsii*, female, upper (5) and under (6) sides. Kerrville, Tex. H. Lacy.

7, 8. *Strymon acadica*, female, upper (7) and under (8) sides. Montana.



GLAUCOPSYCHE AND STRYMON



DANAUS PLEXIPPUS AND AMBLYSCIRTES TEXTOR

Plate 58

Figure 1. *Danaus plexippus plexippus*, male, aberrant. Cabin John, Md., September 19, 1930. Hugh U. Clark.

2. *Danaus plexippus plexippus*, male, aberrant. Cabin John, Md., September 19, 1930.

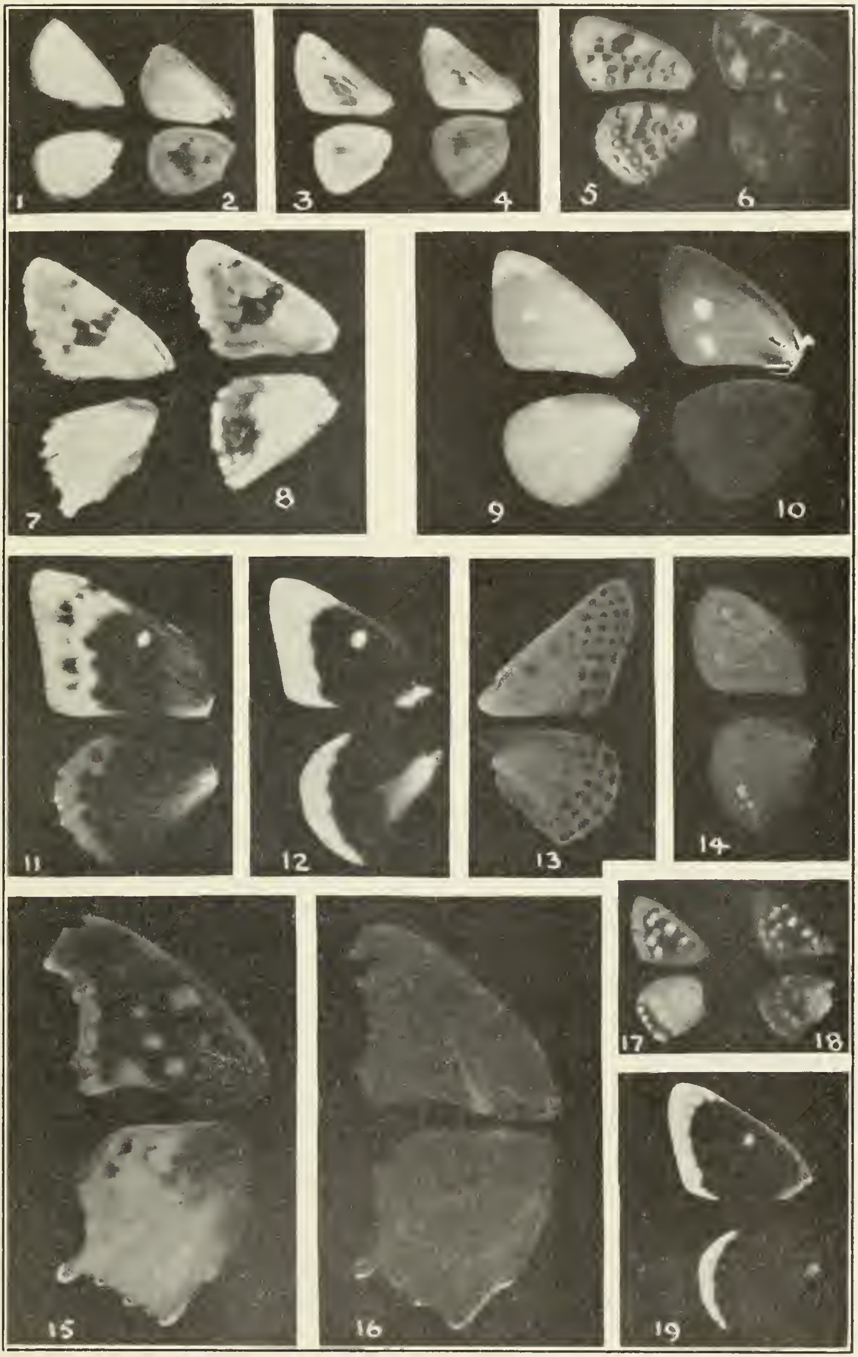
3, 4. *Amblyscirtes textor*, upper (3) and under (4) sides. Wilkesboro, N. C. G. P. Engelhardt, August 9.

Plate 59

Contact pictures; exposure 12 days

FIGURE 1. *Poanes massasoit hughi*, male, fresh specimen, upper side (compare pl. 53, fig. 3).

2. *Poanes massasoit hughi*, right wings of the same specimen, underside (compare pl. 53, fig. 4).
3. *Atrytone pontiac*, male, fresh specimen, upper side (compare pl. 54, fig. 3).
4. *Atrytone pontiac*, right wings of the same specimen, underside (compare pl. 54, fig. 4).
5. *Phyciodes tharos*, female, fresh specimen, upper side (compare pl. 7, fig. 7).
6. *Phyciodes tharos*, right wings of the same specimen, underside (compare pl. 13, fig. 5).
7. *Achalarus lyciades*, female, fresh specimen, upper side.
8. *Achalarus lyciades*, right wings of the same specimen, underside (compare pl. 50, fig. 6).
9. *Pieris rapae*, male, fresh specimen, upper side (compare pl. 28, fig. 2).
10. *Pieris rapae*, right wings of the same specimen, underside.
11. *Colias eurytheme*, female, fresh specimen, upper side (compare pl. 26, fig. 7).
12. *Colias eurytheme*, male, fresh specimen, upper side.
13. *Euphydryas phaëton*, male, upper side (compare pl. 11, fig. 7); third exposure on a specimen caught one month previously.
14. *Neonympha eurytus*, male, upper side (compare pl. 2, fig. 1); third exposure on a specimen caught one month previously.
15. *Polygonia interrogationis*, female, fresh specimen, upper side (compare pl. 10, fig. 3).
16. *Polygonia interrogationis*, right wings of the same specimen, underside.
17. *Chrysophanus phlaeas hypophlaeas*, fresh specimen, upper side (compare pl. 22, fig. 9).
18. *Chrysophanus phlaeas hypophlaeas*, right wings of the same specimen, underside (compare pl. 22, fig. 10).
19. *Colias philodice*, male, fresh specimen, upper side (compare pl. 27, fig. 3).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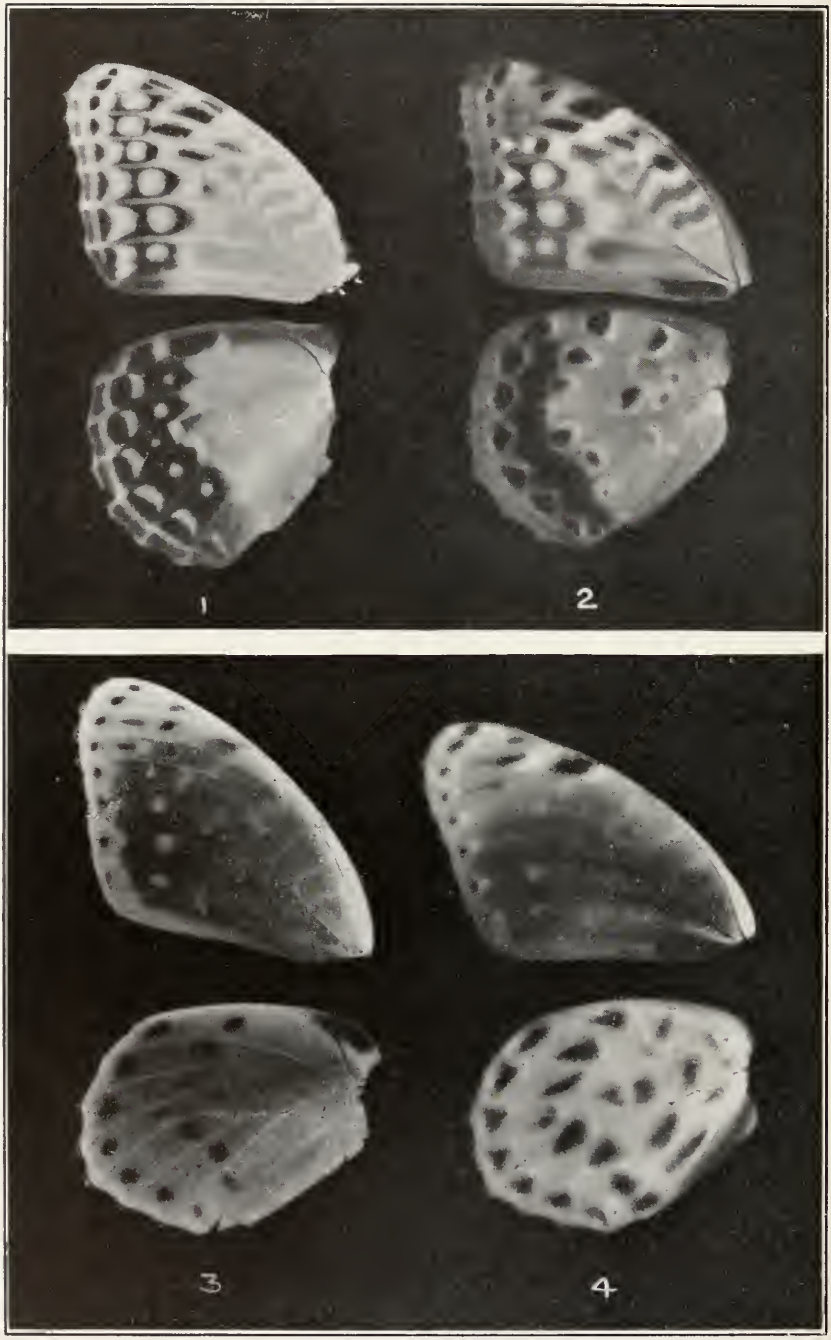
Contact Pictures



Contact Pictures

PLATE 60

Contact pictures; exposure 12 days

FIGURE 1. *Argynnis cybele*, female, fresh specimen, upper side (compare pl. 15, fig. 1; see also pl. 61, figs. 1, 2).

2. *Argynnis cybele*, right wings of the same specimen, underside (compare pl. 15, fig. 2).
3. *Argynnis idalia*, female, fresh specimen, upper side (compare pl. 13, fig. 1).
4. *Argynnis idalia*, right wings of the same specimen, underside (compare pl. 13, fig. 2).

PLATE 61

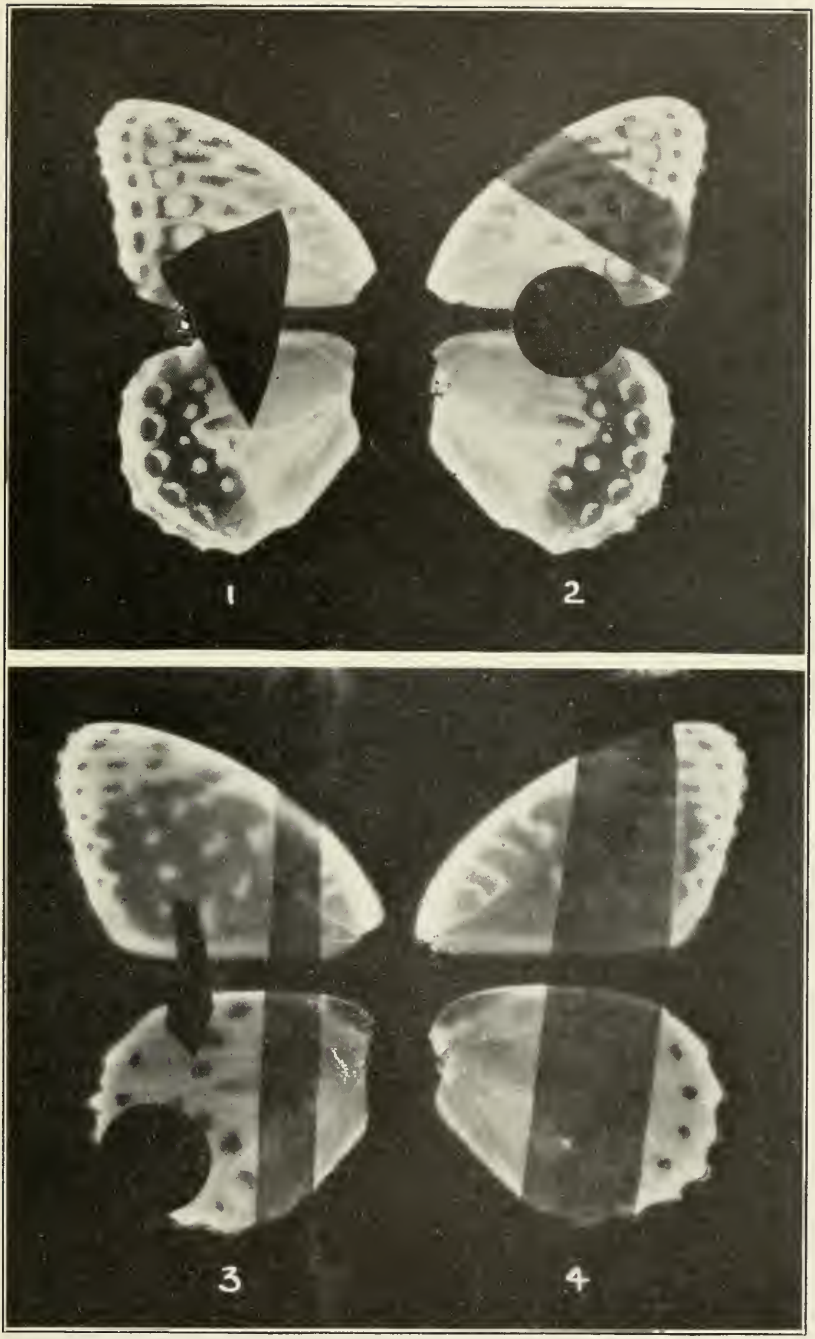
Contact pictures; exposure 12 days

FIGURE 1. *Argynnis cybele*, female, fresh specimen, upper surface (compare pl. 15, fig. 1); the irregular triangle shows the effect of a sheet of quartz 0.2 mm. thick placed between the wings and the plate.

2. *Argynnis cybele*, right wings of the same specimen, upper surface; the dark circle cutting both wings shows the effect of a thin cover glass placed between the wings and the plate, and the dim band running diagonally across the fore wings is caused by a strip of cellophane placed between the wing and the plate.

3. *Argynnis idalia*, female, fresh specimen, upper surface (compare pl. 13, fig. 1); the circular excision in the hind wing shows the effect of a thin cover glass inserted between the wing and the plate; the dim band crossing both wings shows the effect of a strip of cellophane; and the short irregular band cutting both wings above the cover glass shows the effect of a piece of quartz ground to a thickness of 0.2 mm.

4. *Argynnis idalia*, right wings of the same specimen, upper side; the broad dim band shows the effect of a strip of cellophane.



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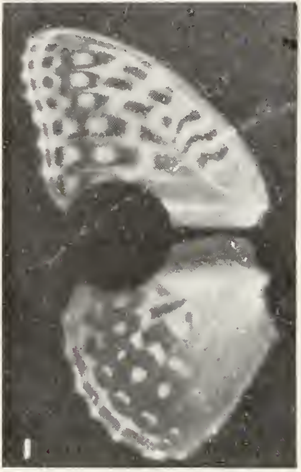
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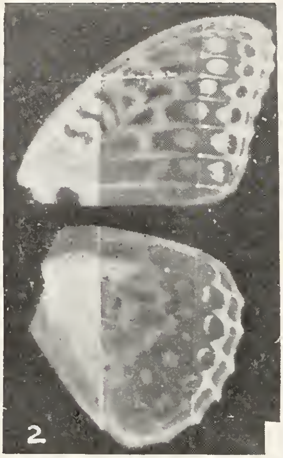
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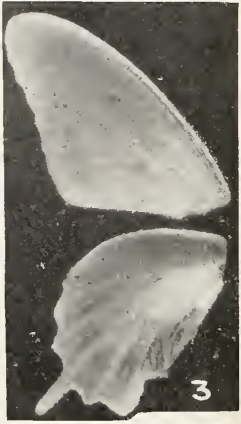
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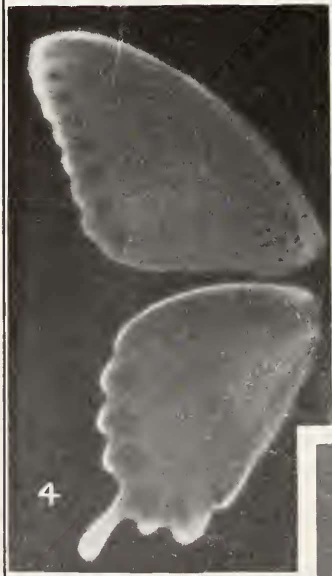
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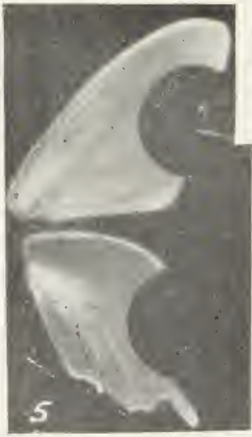
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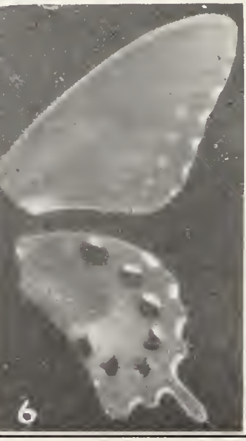
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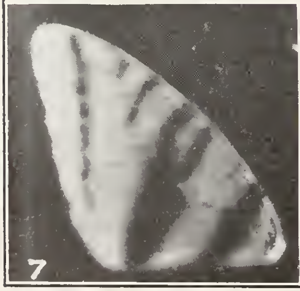
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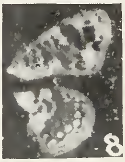
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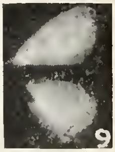
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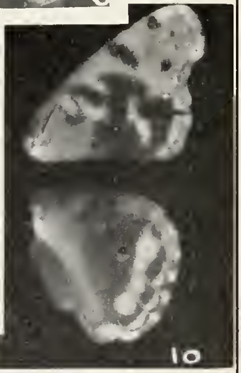
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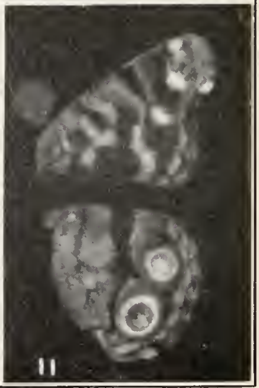
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Plate 62

Contact pictures

Figure 1. *Argynnis cybele*, male, fresh specimen, upper side; the circular excision shows the effect of a cover glass placed between the wings and the plate; exposure 72 hours.

2. *Argynnis cybele*, right wings of the same specimen, upper side; the broad dim band shows the effect of a strip of cellophane placed between the wings and the plate; exposure 72 hours.

3. *Papilio philenor*, small spring form, male, fresh specimen, upper side (compare pl. 30, fig. 1, which is the large summer form of the same species); exposure 72 hours.

4. *Papilio troilus*, male, upper side (compare pl. 45, fig. 1); exposure 12 days.

5. *Papilio philenor*, right wings of the specimen the left wings of which are shown in Figure 3, with cover glasses inserted between the wings and the plate; exposure 72 hours.

6. *Papilio philenor*, female, small spring form, fresh specimen, underside (compare pl. 30, fig. 2, which is the large summer form of the same species); exposure 72 hours.

7. *Papilio marcellus*, female, upper side (compare pl. 48, fig. 1); third exposure on a specimen caught a month previously; exposure 12 days.

8. *Phyciodes tharos*, male, fresh specimen, upper side (compare pl. 59, fig. 5); exposure 72 hours.

9. *Everes comyntas*, male, fresh specimen, upper side (compare pl. 22, fig. 5); exposure 72 hours.

10. *Pyrameis virginiensis*, female, upper side (compare pl. 27, fig. 1); third exposure on a specimen caught a month previously; exposure 12 days.

11. *Pyrameis virginiensis*, left wings of the same specimen, underside (compare pl. 27, fig. 2); third exposure on a specimen caught a month previously; exposure 12 days.

PLATE 63

Contact pictures; exposure 30 days

FIGURE 1. *Papilio glaucus*, female, fresh specimen, upper side (compare pl. 35, fig. 1).

2. *Danaus plexippus*, male, fresh specimen, upper side (compare pl. 6, fig. 4).

3. *Danaus plexippus*, male, fresh specimen, underside.

4. *Junonia lavinia*, female, fresh specimen, upper side (compare pl. 7, fig. 3).

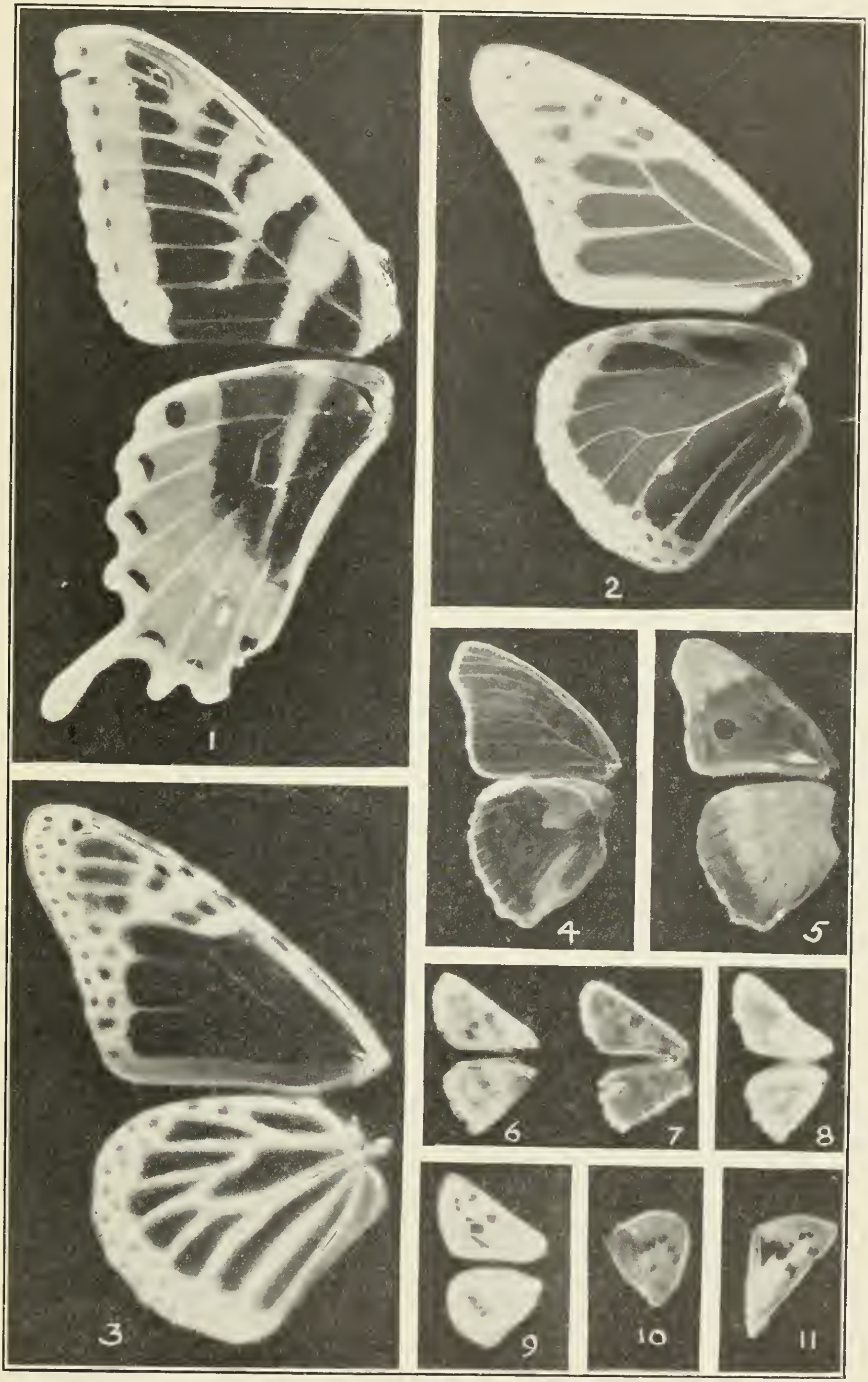
5. *Junonia lavinia*, the same specimen, underside of the right wings (compare pl. 7, fig. 4).

6, 7. *Pyrgus tessellatus*, female, fresh specimen, upper (6) and under (7) sides (compare pl. 32, fig. 3).

8. *Atalopedes campestris*, male, fresh specimen, upper side (compare pl. 35, fig. 2).

9. *Erynnis leonardus*, female, fresh specimen, upper side (compare pl. 16, fig. 6).

10, 11. *Erynnis leonardus*, the same specimen, underside of the right wings (compare pl. 16, fig. 7).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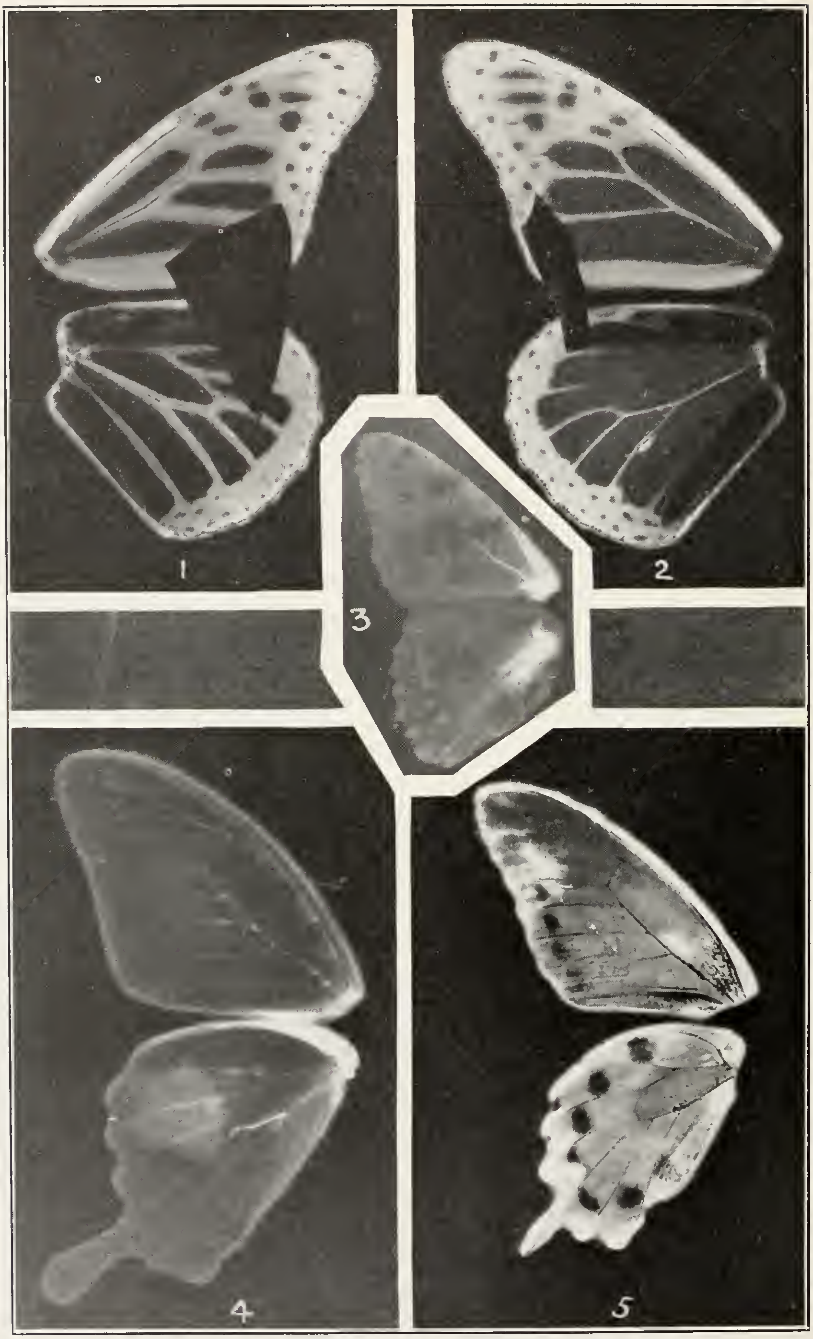

Contact Pictures

PLATE 64

Contact pictures; exposure 30 days

FIGURE 1. *Danaus plexippus*, female, fresh specimen, upper side. The irregular triangle shows the effect of a sheet of quartz 0.2 mm. thick placed over the wing.

2. *Danaus plexippus*, male, fresh specimen, upper side. The irregular band shows the effect of a sheet of quartz 0.2 mm. thick placed over the wing.
3. *Pyrameis cardui*, upper surface of a specimen caught six years before the exposure was made (compare pl. 8, fig. 1).
4. *Papilio polyetor*, upper surface of a specimen caught (in Siam) 10 years before the exposure was made.
5. *Papilio philenor*, female, fresh specimen, underside.

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